Effigies. Authoris.

Arithmetick

Made Eaſier

Than any hitherto Extant;

For the farther Improvement and Intereſt of

TRADES-MEN.

Wherein is exhibited,

That very uſeful SCIENCE, in
a new and more familiar Manner,
in all its Branches, both *VULGAR*
and *DECIMAL*. With the ready
way of computing divers ſorts of
Goods ſold by Retale.

ALSO,

A practical Specimen of Menſuration
of PLAINS and SOLIDS.

By *D. AYRES*, School-Maſter at
the *Hand* and *Pen* near *Hannover*
Square.

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To the Honourable

Sir *John Shadwell*, Kt.

Phyſician in Ordinary to His

MAJESTY.

SIR,

YOur great Concern to grace your witty Offſprings with the moſt elegant and refin'd Accompliſhments, the Honour I had of teaching them ſome Years, and your ardent Love for Arts and Sciences have induc'd me to Shelter this little Offering under your Honour's Protection, which, I preſume, will not only ſerve as their Monitor in my Abſence, but lead to ſuch other Parts of *Arithmetick*, as they may incline to Study: But a further Reaſon of this Dedication is to acknowledge the Favours confer'd on

Your HONOUR's

moſt obliged, and

devoted humble Servant,

Daniel Ayres.

THE

THE PREFACE.

'TIS *not here intended to detain the Reader with Etymology of Words, nor to enter into a curious Diſquiſition after the firſt Founders, or Inventors of this excellent Science. It matters not much who firſt devis'd it, whether they were the* Egyptians, Phœnicians, *or* Arabians. *It's immenſe Value and univerſal Service has ever recommended it to the World, ſo that tho' we are always wanting it's Aid in real Buſineſs, yet it will never ſtand in need of our Encomiums. Out of Gratitude, Nations and States muſt unitedly confeſs it's ſurprizing Effects, Powers and Operations, and every one indeed that contemplates it, muſt acknowledge it one of the moſt worthy and beneficial Arts that was ever diſcover'd.*

And tho' Arithmetick *may lie under the wrong imputation of being auſtere and abſtruſe, yet when her doctrines are well handled, and ſet in a true Light, She will appear perhaps altogether as affable, pleaſant, and engaging as any of the liberal Arts.*

But one Reaſon ſhe bears a ſhy and reſerv'd Aſpect to any is, becauſe ſhe is ſo much neglected, and ſo little practis'd by them; which is too often the Treatment ſhe meets with from the Fair, with whom one wou'd have thought, ſhe might have promis'd a much larger and more intimate Acquaintance; eſpecially conſidering they have ſo much Time, and ſo many Opportunities of Books and Maſters, and that a competent Skill *in* Arithmetick *is, as it were the* Unum Neceſſarium, *or one of the moſt requiſite and preferable Accompliſhments.*

'Tis for want of her ſeaſonable Interpoſition and Directions, that ſome Perſons ſcarce know what they do in Buſineſs, and give ſuch a confus'd Account of it, while others, who have courted this obliging Art, and contracted with her an uſeful Friendſhip, have learnt to keep every thing exact and right, and perhaps are enabled to countermand their Fate by preventing inveitable Loſſes that wou'd otherwiſe enſue. One might name indeed a great many gallant and faſhionable Exerciſes, that are thought by ſome to be more amuſing and indulgent to airy Tempers; which may ſerve, as they phraſe it, to paſs away the Time, but can ſeldom furniſh one Grain of that rational and ſubſtantial Good, ariſing from the Knowledge of this Science.

Wherefore, the whole Scope and Deſign of this Treatiſe is to explicate and reveal the Myſteries of it's Numbers in a new and familiar manner, obvious to any Capacity. The treading, as it were, in the Steps of my Relation, the late Colonel Ayres, *will at leaſt be no diſadvantage to this Undertaking. 'Tis generally allow'd that he was the moſt celebrated Maſter of his Time, who, then by his rare Inventions contributed more than any to the Progreſs of* fine Writing, *and* Arithmetick: *'Twas to his indefatigable Endeavours that we owe the firſt conſiderable Improvements in the Engraving of* Writing, *by enabling the Graver to come ſo near to the Nature and Freedom of the Pen; and 'twas his wonderful Eſſays that were the Source and Fountains from whence the modern Artiſt's have ſince deriv'd and produc'd ſo many elegant and beautiful Performances in Penmanſhip, and graving and painting it.*

The diſcouraging Objection againſt Works of this Nature, that they are too tedious and intricate, will be very much taken off here, becauſe the Whole is ſo ſhort, as well as facil and perſpicuous, and there are ſeveral ſuitable, and profitable Abbreviations.

The Baſis of this Art is plainly demonſtrated Verbatim, *as well as other Parts, becauſe if the Groundwork, or Foundation be but well laid and underſtood, that is, theſe five Rules,* Numeration, Addition, Subtraction, Multiplication, *and* Diviſion, *a Quarter of the Time and Trouble uſually ſpent, may be ſav'd in gaining the frequent Applications of them in* Reduction, the Rules of Three, Practice, Intereſt, Diſcount, Barter, Exchange, Profit and Loſs, *and any other Rules.*

As to Vulgar *and* Decimal *Fractions, 'tis hop'd, that even their craggy Paths are levell'd, and that what this Compoſure offers in that Province, will at leaſt not be be found unacceptable.*

The Menſuration *of* Superficies *and* Solids, *which is of ſuch extenſive Uſe and Profit to ſo many Claſſes of* Mechanicks, *is made here very plain, and a Variety of practical Ways are exhibited and more largely diſcuſs'd than in any thing of this Compaſs and Tendency beſides.*

I am in great hopes that vaſt Benefit will accrue to others from the ſubſequent Tractate, eſpecially to thoſe who haae been illgrounded by illiterate Pretetenders, and have never been ſo happy as to have the Aſſiſtance of an able Maſter, As for ſuch as have formerly learnt a great deal, and it may be, mightily forgot, this, as a friendly Monitor, will be of the utmoſt Utility to them, if they frequently conſult it. In ſhort, 'tis preſum'd, here is ſomething for the Taſte and Intereſt of every one who knows either the Want, or Worth of any of the Branches of this great Pillar of Trades, Offices, and Employments.

Arithme-

Arithmetick.

CHAP. I.

ARITHMETICK is the Science of Computation, or the Art of Numbering, or Reckoning by Figures, in a right and moſt compendious manner, whoſe whole Superſtructure is founded on the firſt Five Rules.

NUMERATION

IS that part of Arithmetick by which we are ſhewn how to read, or write down any Number propoſed; to which End we are to note, that all Numbers are compoſed of theſe Nine Digits, *viz.* 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0 Cypher; which of its ſelf ſignifies nothing, but ſerves to Increaſe or decreaſe Numbers according to its place of ſtanding: So that every one of the Nine Digits have their Value accounted according to the Places of ſtanding; and have two Values, *viz.* one Certain and the other Accidental : The Certain is, when any of them ſtand alone, or by themſelves, as 6 ſix, 5 five, and 9 nine, *&c.* The Accidental Value is according to the Place it ſtands in; ſo that 8, may be Eight, Eighty, Eight Hundred, or Eight Thouſand, *&c.* For if it ſtands alone by it ſelf, it is but Eight, but if it ſtands in the Second place towards the Left-Hand, it is Eight Tens, or Eighty; if in the the Third place Eight Hundreds; and if in the fourth place, Eight Thouſands, *&c.* and ſo of any of the reſt of the Figures : But the order of places, and Value of the Figures accordingly, is beſt diſcover'd by the Table following.

	Hundreds of Millions	*Tens of Millions*	*Millions*	*Hund. of Thouſands*	*Tens of Thouſands*	*Thouſands*	*Hundreds*	*Teus*	*Units*			
	9	8	7	6	5	4	3	2	1	*Mil.*	*Thou.*	*Unit*
Numbers.	1	2	3	4	5	6	7	8	9	123,	456,	789
144		1	2	3	4	5	6	7	8	12,	345,	678
2700			1	2	3	4	5	6	7	1,	234,	567
30762				1	2	3	4	5	6		123,	456
570620					1	2	3	4	5		12,	345
4200067						1	2	3	4		1,	234
72406070							1	2	3			123
57[illegible]007047								1	2			12
									1			1

By this Table we may obſerve that every Figure from the Right Hand to the Left Increaſes by a ten-fold proportion; ſo that by getting by Heart, the Words at the Head of the Table, and the Number of places, as Units, Tens, Hundreds, Thouſands, Tens of Thouſands *&c.* we are enabl'd to read and Write down Numbers accordingly; but for the eaſier reading the ſaid Table, I have ſet down the Numbers by Periods on the right Hand of it, and over them Units, Thouſands, and Millions and alſo the other Numbers on the left, are ſet Exerciſe of the Learners Ability.

The firſt Line of the Table to be read thus: One Hundred Twenty Three Millions, Four Hundred fifty ſix Thouſand, Seven Hundred Eighty Nine, *&c.* And the laſt Number on the Left to be read thus; Five Hundred Seventy Two Millions, Seven Thouſand and Forty Seven, *&c.*

CHAP. II.

Of ADDITION.

ADDITION is an Arithmetical gathering of ſeveral Numbers into one Total or whole Sum.

Addition is of one Denomination, or of ſeveral; of one Denomination, when the Numbers are all of one kind or ſort, as Yards, Gallons, Pounds, Ells, Acres, *&c.* And are to be ſet in ſuch order, in direct Lines, from the higheſt to the loweſt; that Units may ſtand under Units, Tens under Tens, and Hundreds under Hundreds, *&c.* As,

Thus :

X of Thouſands	*Thouſands*	*Hundreds*	*Tens*	*Units*
7	4	5	9	7
	4	6	5	0
	3	7	4	2
		8	7	6
			4	2
				9

7	4	5	6	7	
	4	6	5	0	
	3	7	4	2	
		8	7	6	
			4	2--	} wrong
				9--	}

So that 9 muſt not ſtand under the 4 for then it would be caſt up as 9 Tens, whereas it is but 9 Units, or Ones, nor the 42 under 87 for then the 4 would be caſt up as 4 Hundreds, when it is but 4 Tens, and the 2 Units as 2 Tens becauſe wrong plac'd as on the right-hand may be obſerv'd —— Note it is not material whether the greater or leaſt Number be uppermoſt, provided they ſtand in their due Rank, ſo that 9 might have been firſt, and 74567 the laſt Number, and yet the Total the ſame —— In caſting up Numbers of one Denomination, we muſt always (after a Line drawn underneath) remember to begin to reckon at the Right-Hand, and for every Ten in each Row, to carry one to the next Row, having firſt ſet down under the Line what is over Ten, or Tens, as ſuppoſe the firſt Row amounts to 26 I ſet down 6 under the Line in its proper place, and carry 2 for the two Tens, to the next Row ; and when any of the Rows come to juſt even Ten or Tens and nothing over, as 20, 30, 40, *&c.* then ſet down 0, nothing and carry ſo many Ones as there were Tens in the Rank, to the next Rank or Row; and what ever the laſt Rank amounts to, ſet it down.

Example.

In this Example I begin at the Bottom towards the Right-Hand as before directed; ſaying 4 and 1 is 5, and 4 is 9, and 7 is 16, and 6 is 22, and 4 is 26, and 9 is 35, wherefore I ſet down 5 in its proper place, that is, juſt under the Row I have caſt up, and carry 3 for the 3 Tens contain'd in it, to the next Rank, ſaying 3 that I carry and 6 is 9, and 7 is 16, and 2 is 18, and 2 is 20, and 7 is 27, and 6 is 33, ſo that I ſet down 3 and carry 3 for the 3 Tens to the next, ſaying 3 that I carry and 5 is 8, and 4 is 12, and 7 is 19, and 2 is 21, and 4 is 25, I ſet down 5 and carry 2 for the Two Tens to the next Row ſaying 2 that I carry and 5 is 7, and 4 is 11, and 7 is 18, which being the laſt Row I ſet down 18, (otherwiſe I muſt have ſet down 8 and carried 1) ſo the work is done, and the Total Number of Gallons is 18535 as in the Margin.

Gall.
7469
274
6
27
4724
564
5471
18535

Thus are done all ſums in Addition of one Denomination; as may be ſeen in the following Examples ſet on purpoſe for the Learners Practice.

Pounds	*Gallons*	*Ells*	*Acres*	*Yards*	*Pounds*
47	69	472	42	4762	57246
74	96	600	24	3267	749
42	37	47	67	7246	24271
67	73	10	76	4007	472
76	62	9	9	3742	2372
60	47	426	41	7269	72430
366	384	1564	259	30293	157540

But that nothing be wanting to make every thing plain and Inteligible I have ſubjoyn'd the familiar Examples following, *viz.*

Example 1. Suppoſe a Perſon owes to ſeveral others as follows, *viz.* To A 24 pounds, to B 17 pounds, to C 20 pounds, to D 14 Pounds, to E 6 pounds, F 13 pounds, and to G 12 pounds. How many pounds doth he owe in all ? *Anſwer.* 106 *l.* as may be ſeen in the Margin.

	l.
A	24
B	17
C	20
D	14
E	6
F	13
G	12
	106

Ex. 2. Again, Admit that in the late War with *France* the Queen had in *Flanders*, 30719 Men, in *Germany* 12400, in *Spain* 15760, in *Portugal* 4769, in the Navy 34760, and at Home 17620, how many Men in all were in Her Majeſty's Service ? *Anſwer*, 116028, as in the following Sum.

Flanders,	30719
Germany,	12400
Spain,	15760
Portugal,	4769
Navy,	34760
Home,	17620
Total	116028

Ex. 3. Guag'd ſeveral Casks of Wine, containing, *viz.* one qt. 146 Gallons, another qt. 204, another 79, a fourth, qt. 256, a fifth qt. 94, the ſixth qt. 114 Gallons: How many Gallons were there in all? *Anſw.* 893, as in the Example.

	Gallons.
	146
	204
	79
	256
	94
	114
In all,	893

Ex. 4. Meaſur'd 6 Pieces of Cloth, containing, *viz.* Nº 1 qt 46 Yards; 2, 70 Yards; 3, 56 Yards; 4, 41 Yds. 5, 12 Yards; and No. 6, 45 Yards: How many Yards in all? *Anſw.* 270 Yards, as in the Margin.

Nº	Yds.
1	46
2	70
3	56
4	41
5	12
6	45
Total	270

To Prove Addition.

The beſt and moſt practicable way, is to begin at the Top on the Right-Hand and caſt it downwards, as before Upwards, and if it prove the ſame, the Work is righe, otherwiſe not, wherefore they muſt be caſt upwards and downwards till they do agree.

Addition of ſeveral Denominations is, when the ſeveral Lines conſiſt of divers Names; as of Pounds Shillings, Pence, Farthings, *&c.* or of Tuns, Hundreds, Quarters, Pounds weight *&c.* Yards, Quarters, Nails.

Of

Of Money.

The Current Coin of this Nation is made of Copper, Silver, or Gold; of Copper is made Farthings, and Half-pence; of Silver, Pence, Two-pences, Three-pences, Groats, Six-pences, Shillings, Half-Crowns, and Crowns: of Gold is made half Guineas, Guineas, Jacobuſſes, Caroluſſes, Five Guinea-pieces, and ſome other antient Pieces. —— But beſides theſe, we appropriate other Names to Money, of which we have no particular Coin; as *Nobles*, *Angels*, and *Marks*; the Noble is 6*s.* 8*d.* the Angel 10 Shillings, and the Mark 13*s.* 4*d.* Notwithſtanding theſe ſeveral Denominations of Money, we keep our Accounts in Pounds, Shillings, Pence, and Farthings, only, A Table of which follows, *viz.*

In a Pound Sterling are, {
960 Farthings,
240 Pence,
60 Groats.

			Marks.
4 Farthings	make,	1 Penny	*d.*
12 Pence		1 Shilling	*s.*
20 Shillings		1 Pound	*l.*

The Marks are taken from the *Latin* names *l.* *Libræ*, *s.* *Solidi*, *d.* *Denarii*, and *Farthings*, or *qr.* *Quadrantes*; but Farthings, or the Fractions of a Penny, are generally, and beſt, ſet thus, $\frac{1}{4}$, a Farthing; $\frac{1}{2}$, a Half-penny; $\frac{3}{4}$, Three-Farthings, that is, a quarter of a Penny, Half a penny, and Three-quarters of a Penny.

Addition of MONEY.

Before we proceed to Examples in this Rule it is neceſſary that the following Tables be learnt by Heart, *viz.*

d	s	d	Pence	Shil.	Shil.	l.	s.
20-is,-	1	8	24-is,-	2	30	1	10
30	2	6	36	3	40	2	00
40	3	4	48	4	50	2	10
50	4	2	60	5	60	3	00
60	5	0	72	6	70	3	10
70	5	10	84	7	80	4	00
80	6	8	96	8	90	4	10
90	7	6	108	9	100	5	00
100	8	4	120	10	110	5	10
110	9	2	132	11	120	6	00
120	10	0	144	12			

Example (1*ſt.*)

Admit a Perſon hath owing to him from ſeveral others, ſuppoſe ſix, *viz.* One owes him 5*l.* 4*s.* 6*d*; another 7*l.* 11*s*, 9*d*; a Third 4*l.* 7*s.* 5*d*; a Fourth 8*l* juſt, the Fifth 7*l.* 8*s.* 4*d*; and the Sixth ows him 9*l.* 7*s.* 6*d*; how much is owing to him in all from theſe ſeveral perſons, Anſwer. 41*l.* 19*s.* 6*d.*

l.	s.	d.
5	04	6
7	11	9
4	07	5
8	00	0
7	08	4
9	07	6
41	19	6

To find which Total, ſet down the ſeveral Sums, one under the other as in the Margin, ſo that each Name may ſtand directly under the other of the ſame Name, *viz.* Pounds under Pounds, Shillings under Shillings, and Pence under Pence, as it is in the Example. As to the Marks Tradeſmen vary in the Methods of ſetting them down; ſome ſet the Marks over the ſeveral Demominations, thus,
l. *s.* *d.*
5 4 6; others ſet the Mark after each Name, thus 5*l.* 4*s.* 6*d.* and ſome again ſet the Mark of Pounds only before the firſt Line; and take the other Denominations Conſequentially thus *l* 5, 4, 6; ſo that after Pounds follow Shillings, and after Shillings neceſſarily ſucceed Pence: The laſt is very elegant, but I ſhall follow the Firſt Method as moſt Practicable in Teaching. In caſting up this Example, and all others in this Rule, we have recourſe to the Table of Money, that is, how many of the ſmaller Name make one of the next greater, *viz.* for every 4 in the Farthings carry one to the denomination of Pence; for every 12 in the Pence carry one to the Shillings, and for every 20 in the Shillings one to the Pounds: Becauſe 4 Farthings make 1 penny, 12 pence 1 ſhilling, and 20 ſhillings 1 pound. Having drawn a Line underneath the ſeveral ſums I begin with the leaſt denomination toward the Right-Hand (as in all Additions whether of Money Weight or Meaſure we muſt)(which in this Example is Pence) ſaying 6 and 4 is 10, and 5 is 15, and 9 is 24, and 6 makes 30, now 30 pence as in the Table make 2 Shillings 6 pence, I put down the 6 pence that is over the 2 Shillings under its proper Rank to wit under pence, and carry the 2 Shillings to the Row of Shillings; ſaying 2 that I carry and 7 is 9, and 8 is 17, and 7 is 24, and 1 is 25, (leaving the ten in the 11 and take it as I come down from

the top) and 4 is 29, and the Ten aforeſaid makes 39 ſhillings, wherefore I ſet down the odd 19 ſhillings under its own Rank, and carry the 1 Pound to the Pounds, ſaying 1 that I carry and 9 is 10, and 7 is 17, and 8 is 25, and 4 is 29, and 7 is 36, and 5 makes 41 pounds; ſo the total of this ſum is 41*l.* 19*s.* 6*d.* as in the Example. —— Whenever it happens that the Number of Farthings in the Row of Farthings make juſt ſo many even and nothing over, do not ſet any thing down but carry thoſe pence to the Row of pence; and if it happens, that in the Rank of pence they make juſt even ſhillings, then ſet down 0, and carry the ſhillings they make to the ſhillings, and if the Row of ſhillings make juſt even pounds ſet down 00, and carry the pounds to the pounds ——

Admit a Wholeſale Trader looking over his Books and Ballanceing them finds due to him from ſeveral perſons as follows, *viz.* I begin at the Bottom of the Right-Hand, ſaying 1 and 3 is 4, and 2 is 6, and 3 is 9 Farthings which is 2*d* farthing I ſet down ¼ and carry 2*d*, then 2 that I carry and 7 is 9, and 6 is 15, and 2 is 17, and 6 is 23, and 9 is 32, and 1 is 33, and 1 is 34, and 6 is 40, and 6 is 46 pence, and 10 is 56, and 10 is 66 pence, now 66 pence is 5*s*, and 6 pence, I ſet down 6*d.* and carry 5*s.* to the Shillings; ſaying 5 that I carry and 2 is 7, and 9 is 16, and 1 is 17, and 1 is 18, and 7 is 25, and 9 is 34, and 2 is 36, then I come down with the Tens, ſaying 36 and 10 is 46, 56, 66, 76, 86, 96, 106, 116, and 10 is 126, Shillings or 6 pounds 6 Shillings wherefore I ſet down 6*s.* under the Shillings and carry 6 pounds to the pounds taking the firſt Row and ſay 6 that I carry and 9 is 15, and 6 is 21, and 1 is 22, and 5 is 27, and 4 is 31, and 4 is 35, and 7 is 42, and 9 is 51, and 9 is 60, and 7 is 67, I ſet down 7 and carry 6 for the 6 Tens (for the pounds are always caſt up as ſums of one Denomination for every 10 carrying one to the next Row; and in all additions whether of Money, Weight, or Meaſure, *&c.* that Denomination towards the Left-Hand, muſt be ſo caſt up) ſaying 6 that I carry and 7 is 13, and 7 is 20, and 4 is 24, and 1 is 25, and 7 is 32 and 4 is 35, and 5 is 41, and 4 is 45, and 1 is 46, and 4 is 50, which is 5 Tens and nothing over wherefore I ſet down 0, and carry 5, ſaying 5 that I carry and 1 is 6, which I ſet down in the Third and laſt place. So that the Work is done, and the Total ſum is 607*l.* 06*s.* and 6*d* ¼ as in the Example may be ſeen ——

	l.	*s.*	*d.*
A——	47	10	6
B——	19	10	0
C——	49	12	6¾
D——	57	19	11
E——	40	00	0
F——	74	10	11½
G——	14	17	9
H——	5	00	0
J——	1	01	6
H——	146	11	2¼
L——	70	19	6
M——	79	12	7¼
	607	06	6¼

Now follow ſome Examples for the Learners Practice.

l.	*s.*	*d.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*
57	17	10¼	39	17	10¼	19	14	10¼
41	19	11½	19	12	10½	57	17	9½
57	14	10¾	19	19	11¾	47	12	11¼
97	16	9½	19	17	11¾	41	19	11¼
16	10	11¼	19	17	7¼	34	17	10½
87	17	10½	71	10	9½	98	19	10½
16	18	11¼	57	15	1½	31	17	11¾
87	19	10¾	72	16	10¼	57	15	7¼
464	17	1¾	321	09	00¾	390	16	10¼

Uſeful Tables of Parts, for the more ready adding of the Weights and Meaſures uſed in *England*; for by knowing the Affinity that one Denomination bears to another; the Learner may be able to caſt up any ſort of Addition whatſoever.

Of Avoirdupoiſe Weight.

16 Drams	make,	1 Ounce,
16 Ounces		1 Pound,
28 Pounds		1 Quarter of a Hundred,
4 Quarters		1 Hundred,
20 Hundreds each 112 Pound		1 Tun.

By this Weight is weighed all ſorts of Grocery; alſo, Druggs, Iron, Braſs, Copper, Lead, Tallow, Soap, Fleſh, *&c.*

Troy-Weight.

24 Grains,	make	1 Penny-Weight.
20 Penny-Weight,		1 Ounce.
12 Ounces,		1 Pound.

By this Weight is weigh'd Silver, Gold, Jewels, and Electuaries.

Apothecaries Weight.

			Marks.
20 Grains	make,	1 Scruple	℈
3 Scruples		1 Dram	ʒ
8 Drams		1 Ounce	℥
12 Ounces		1 Pound	℔

Cloth Meaſure.

4 Nails	make,	1 Quarter
4 Quarters		1 Yard
5 Quarters		1 Ell *Engliſh*
3 Quarters		1 Ell *Flemiſh.*

Avoir-du-poize Weight.

(10)	(20)	(4)	(28)	(10)	(20)	(4)	(28)
Tuns	C.	*qrs:*	lb.	*Tuns*	C.	*qrs.*	lb.
14	15	3	12	46	13	1	16
29	12	1	24	15	14	3	24
17	14	1	28	40	12	1	07
19	17	2	04	13	12	3	17
82	00	1	12	116	13	2	08

(10)	(20)	(4)	(28)
Tuns.	C.	*qrs.*	lb.
24	15	2	20
17	17	1	17
42	19	3	27
29	14	2	20
115	07	03	00

			(10)	(4)	(28)			
C.	*qrs.*	lb	C.	*qrs.*	lb.	C.	*qrs.*	lb.
2	1	06	12	1	17	4	1	11
7	1	14	15	1	19	2	2	17
4	3	15	24	3	11	4	1	07
6	0	14	16	1	12	2	2	15
4	2	14	24	1	06	4	0	21
25	1	07	93	1	19	18	1	15

(10)	(16)	(16)	(10)	(16)	(16)	(10)	(16)	(16)
lb.	*oz.*	*dr.*	lb.	*oz.*	*dr.*	lb.	*oz.*	*dr.*
71	14	06	7	07	14	46	21	14
20	11	14	2	06	07	15	12	13
10	04	09	4	10	14	41	07	06
14	06	14	5	06	14	54	12	15
21	14	06	4	14	06	43	03	14
139	04	01	24	14	07	202	00	14

Troy Weight.

℔	*oz.*	*dwt.*	*gr.*
7	10	12	20
8	04	06	13
9	06	07	06
7	01	05	21
34	10	12	12

	(12)	(20)	(24)
℔.	*oz.*	*dwt.*	*gr.*
11	11	15	13
4	04	14	23
8	10	09	08
9	07	12	15
34	10	12	11

(10)	(20)	(24)
oz.	*dwt.*	*gr.*
204	13	12
74	12	20
614	10	12
90	19	23
984	16	19

Apothecaries Weight.

(10)	(12)	(8)	(3)
℔	℥	ʒ	℈
48	07	1	1
74	05	2	2
17	10	1	1
10	11	5	2
17	07	7	1
10	09	6	2
180	04	1	0

(10)	(12)	(8)	(3)
℔	℥	ʒ	℈
74	05	7	1
19	11	4	1
18	07	5	2
14	09	6	2
10	11	7	2
11	10	6	1
150	09	6	0

(10)	(12)	(8)	(3)
℔	℥	ʒ	℈
10	10	5	2
17	11	6	1
10	10	7	1
12	11	4	1
10	10	2	2
11	11	3	2
75	06	6	0

Cloth Meaſure.

(10)	(4)	(4)
Yd.	*qrs.*	*N.*
14	1	3
21	2	2
56	1	0
42	2	3
17	0	1
24	1	2
176	1	3

(10)	(5)	(4)
Ell E	*qrs*	*N.*
24	3	3
17	4	1
46	2	2
27	1	0
34	4	3
51	2	2
202	3	3

(10)	(3)	(4)
Ells F.	*qrs.*	*N.*
25	2	3
36	1	2
42	2	3
54	2	1
61	1	2
221	1	3

Here I forbear giving Verbal Demonſtrations to any of the Examples above as unneceſſary ; but ſet the Numbers to ſtop at, over each Denomination ; which makes them very eaſy to caſt up.

The Proof of any of theſe Examples of Adittion is by the ſame Method as directed in thoſe of one Denomination, *viz.* by beginning at the Top, and caſting them downwards till they agree.

CHAP. III.

SUBTRACTION.

TEaches to take a leſſer Number out of a greater, whereby we find the Reſt, Remainder, Exceſs, or Difference.

In ſubtracting of Numbers of one Denomination, they muſt be ſet down for Working as directed in Addition, *viz.* Units under Units, Tens under Tens *&c.* but the greater Number muſt be uppermoſt, as in this Example.

	Pounds.
Money received, ———	296
Money paid, ———	152
Remains unpaid, ———	144

After a Line drawn underneath, I begin at the Right Hand and ſay, 2 from 6 and there remains 4, and 5 from 9 and there remains 4, and 1 from 2 and there remains 1. So there remains in Hand 144 Pounds, as in the Work.

Again. Suppoſe I would ſubſtract 496 pounds, from 654 pounds, lent; I ſet the Numbers down thus as before directed.

654 *Pounds*
496 *Pounds*

158 *Anſ.*

654 *Proof.*

And here you are eſpecially to note, that when any of the under Figures are greater than the Figure over them, then you muſt borrow 10 (as you carry'd 10 in Addition) and put it to the Figure or Cypher from whence you are to ſubtract, and then take from their Sum, paying 1 for the ſaid 10 borrowed, to the next Figure towards the Left Hand in the lower Line, *&c.* After a Line drawn under the Numbers I ſay, 6 from 4 I cannot, but (putting 10 to the ſaid 4, it is made 14) 6 from 14 and there remains 8, which I ſet down under the Line, then I ſay 1 that I borrow'd, and 9 (the next Figure) is 10, from 5 I cannot, but 10 from 15 (adding 10 to the 5) and there remains 5, which I alſo ſet down: then 1 that I borrow'd, and 4 is 5, from 6 and there remains 1, and ſo the Example is done: And I find there remains unpaid 158 pounds as in the ſame Margin may be obſerv'd. To prove this and all other Examples in Subtraction; add the Remainder, or Difference to the leſſer Sum, and if it make the upper or greater Number it is right, otherwiſe not: As in the Example I ſay 8 and 6 is 14, 4 and carry 1, 1 and 5 is 6 and 9 is 15, 5 and carry 1, 1 and 1 is 2, and 4 is 6 which Figures agree with the Top Line and ſhew that the Subſtraction is right.

Other Examples for Practice.

	℔		*Ells*	*Gallons.*	
Due	147	Bought	7460	4175	From
Paid	79	Sold	5967	2790	Take
Remainder	68		1493	1385	
Proof	147		7460	4175	

Time.

	1722		1722		1722	
	1605	Gun-Pow. P.	1066	*Wm.* I.	1666	Fire *L*
Since	117		656		56	

☞ *Note*, this general Rule, that in all Subtractions, whether of Money, Weight, Meaſure, *&c.* whatever you ſtop at in Addition, you muſt borrow in Subtraction if need require.

Subtraction of Money.

In Subtraction of divers Denominations the ſame Method muſt be obſerv'd as before in Addition, that every Number be ſet in due order with reſpect to the Denomination, that is Pounds under Pounds; Shillings under Shillings, and Pence under Pence; and the greater Number or Sum always uppermoſt; then Note how many of the leaſt Denomination make one of the next greater, beginning at the right hand and going towards the left, and if the Figure or Figures be greater than thoſe you are to ſubtract from, you muſt borrow 1, from the next greater Denomination, and then ſubtract from it, and add the remainder to the upper Figure.

	℔	*s.*	*d.*
Receiv'd	519	18	4 ¼
Paid	327	11	6 ½
Unpaid	192	06	09 ¾

Exampl

Example. Let it be required to ſubtract *l* 327, 11, 6 ½ from *l*519, 18*s*, 4*d* ¼. Having ſet down the two Sums the greater uppermoſt, and the leſſer underneath (as above) having drawn a Line under them, I begin at the right hand ſaying, 2 Farthings from 1 I cannot, but borrowing 1 of the next Denomination which are pence, 1 of which makes 4 Farthings) 2 from 4 and there remains 2, which added to the Farthing on Top makes ¾, which I ſet down under the Line, and proceed, ſaying, 1 (penny) that I borrow'd and 6 is 7, 7 *d*, from 4 *d* I cannot, but 7 *d* from 12 *d* (borrowing a Shilling, the next Denomination) and there remains 5 *d*, which put to the 4 *d* over it, makes 9*d*, which I alſo ſet down under the Line in its proper place; then 1 that I borrow'd and 11 is 12 from 18 and there remains 6 *s*. then 7 from 9 and there reſt 2, then 2 from 1 I cannot, but 2 from 11 (putting 10 the 1 as in Subtraction of one Denomination) and there remains 9; then 1 that I borrowed and 3 is 4 from 5 and there remains 1. So that the Remainder unpaid is, *l*. 192, 06, 9¾, as in the Work.

Examples for Practice.

	℔	*s.*	*d.*	℔	*s.*	*d.*	℔	*s.*	*d.*
Recd.	402	10	0	741	16	0	107	10	2
Disb.	391	19	2	392	11	8	98	16	6
Rem.	10	10	10	349	04	4	8	13	8
Proof	402	10	0	741	16	0	107	10	2

	l.	s.	d.	l.	s.	d.	l.	s.	d.
Rd.	976	11	2¼	471	10	10	2477	10	0½
Pd.	795	16	3½	296	17	4½	979	16	2¼
Rm.	180	14	10¾	174	13	5½	1497	13	10¼

When it happens that a Sum of Money firſt due is paid at ſeveral Payments; or that ſeveral Diſburſements are out of a certain Sum receiv'd; then the Money firſt due, or the Money receiv'd, ſtands uppermoſt, with a Line under it, and the ſeveral Payments or Diſburſements ſtand in their Order under that Line which muſt be added together, and the total muſt be ſubtracted from the uppermoſt Line, and the remainder ſhews what remains due, or undiſburſed, as in the Examples following.

Firſt due, *l.*	75	12	6	Recd *l.*	275	15	0
Receiv'd at ſeveral times,	06	10	0	Diſburſt on ſeveral Occaſions.	50	00	0
	12	00	0		30	10	0
	19	15	6		70	10	6
	25	00	0		75	15	0
Recd in all	63	05	6	Diſburſt in all	226	15	6
Rem. due	12	07	0	Reſting in hand	48	19	6
Proof	75	12	6		275	15	0

	l.	s.	d.
In a Bag,	50	00	0
Paid to ſeveral Perſons.	5	05	0
	10	10	0
	7	7	6
	20	00	0
Paid in all	43	2	6
Rem. in Bag	06	17	6
	50	00	0

Theſe three laſt Examples are ſo pertinently laid down with reſpect to the foregoing verbal Demonſtration, that there is no need of more Words for Explication.

The Proof of Subtraction of Money, is ever performed in the manner beforemention'd.

Subtraction of Avoir-du-poize Weight.

	(10) *Tuns*	(20) *C.*	(4) *qrs.*	(28) ℔	(10) *C.*	(4) *qrs.*	(28) ℔.
From	24	12	3	12	224	1	20
Take	17	09	3	22	127	2	16
Rem.	7	02	3	18	96	3	04
Proof	24	12	3	12	224	1	20

(10) *C.*	(4) *q.*	(28) ℔.	(10) *C.*	(16) *q.*	(16) ℔.
431	1	12	75	11	12
275	2	16	49	13	14
155	1	24	25	13	14
431	1	12	75	11	12

	T: C. q. ℔.		*C. q.* ℔.
Bought	75-12-1-14 of Iron.		437-2-20 of Sugar.
Sold at Times,	5-12-1-16 2-10-0-00 20-13-3-14 16-17-2-20	Sold at times	24-1-14 124-2-16 45-1-17 216-3-24
Sold in all	45-13-3-22	Sold in all	411-1-15
R. unſold	29-18-1-20	Re. unſold	26-1-05
Proof	75-12-1-14	Proof	437-2-20

Troy-

Troy-Weight.

	(10)(12)(20)(24) ℔. *oz. dwt. gr.*		(10)(20)(24) *oz. dwt. gr.*
Bought	65--06--10--12	Recd	5226--07--22
Melt.down	47--09--11--20	Deliver'd	3599--10--16
Remains	117--08--18--16	Remains	1626--17--06

And ſo of Apothecaries Weight, Cloth Meaſure, Liquid Meaſure, *&c.* of which I might give Examples, but they all being work'd after the ſame Method, (having reſpect to the ſeveral Tables of Quantity) I therefore forbear; but ſhall ſubjoin ſome familiar Examples, which ſhew the Intent and Uſes of Subtraction.

Ex. 1. One born in the Year of our Lord 1616, deſired to know his Age in the Year 1676; What was his Age?

Year	1676
Born	1616
Anſ.	60

Ex. 2. Admit a Perſon to be 52 Years old, this preſent Year 1722; What was the Date of the Year he was born in? *Anſw.* In 1670. For ſubtracting his Age from the preſent Year, the Difference gives the Date of his Birth, as *p.* Example.

Year	1722
Age	52
Anſw.	1670

Ex. 3. Suppoſe I have a large Cask of Tobacco, containing 2724 ℔. and have ſold at ſeveral times 1966, what remains in the Cask?

	2724
	1966
Anſw.	758

Ex. 4. What number of Pounds added to will make it up to 650 ?

650
470
—
Anſwer, 180

Ex. 5. Bought 490 Gallons of Brandy, and ſold 327, what remains ?

490
327
—
Anſwer, 163

Ex. 6. Admit a Ship hath 922
Leagues to ſail, and hath ſailed 555
how far is to Port ?
—
Anſw. 367 Leagues.

Ex. 7. What Sum of Pounds, Shillings and Pence, muſt be added to *l.* 72 6*s.* 8*d.* to make it up *l.* 130 10*s.* 0*d.* *Anſwer,* *l.* 58 3 4, as in the Work.

l. 130-10-0
72-6-8
—
l. 58-3-4

Ex. 8. Suppoſe I have bought Iron, *T. C. q.* lb 24-12-2-20
And Sold 17-14-1-22
—
What remains unſold ? *Anſ.* 6-18-0-26

CHAP. IV.

MULTIPLICATION.

TEaches how to increaſe the greater of two Nnmbers given, as often as there are Units in the leſſer; and compendiouſly performs the Office of Addition. To this Rule belong three principal Members, *viz.*

The { *Multiplicand*, or Number to be multiply'd.
Multiplier, or Number by which you multiply:
Product, or Number produced by multiplying.

But before any Progreſs can be made, the following Table muſt be learnt readily by heart.

Multi-

Multiplication T A B L E.

2 times	2 is,	4
	3	6
	4	8
	5	10
	6	12
	7	14
	8	16
	9	18
	10	20
	11	22
	12	24
3 times	3 is,	9
	4	12
	5	15
	6	18
	7	21
	8	24
	9	27
	10	30
	11	33
	12	36
4 times	4 is,	16
	5	20
	6	24
	7	28
	8	32
	9	36
	10	40
	11	44
	12	48
5 times	5 is,	25
	6	30
	7	35
	8	40
	9	45
	10	50
	11	55
	12	60
6 times	6 is,	36
	7	42
	8	48
	9	54
	10	60
	11	66
	12	72
7 times	7 is,	49
	8	56
	9	63
	10	70
	11	77
	12	84
8 times	8 is,	64
	9	72
	10	80
	11	88
	12	96
9 times	9 is,	81
	10	90
	11	99
	12	108

The form of this Table I prefer before the *Pythagorean*; made in a Square; as much eaſier for Learners.

Wheu any Number is given to be multiplied by another, ſet the biggeſt uppermoſt, which is the Multiplicand, and under that the leſſer, which is your Multiplier and in the ſame Order as in Addition and Subtraction; *viz.* Units under Units, Tens under Tens, *&c.* then draw a Line, and proceed, beginning at the right hand; to wit, at the place of Units, and multiply every Figure of the Multiplicand, by the Figure (or Figures) of the Multiplier; and ſo proceed towards the left hand, ſetting down each particular Product (if under 10) under the Line, in order as you proceed; but when the Product of any two Figures amounts to 10, or juſt to any certain Number of Tens, as 20, 30, 40, *&c.* ſet down a Cypher or 0, and carry 1 for every 10, (as in Addition) to the Product of the next Figure; but if it comes under 10, or above Ten, or Tens, ſet down the Figure under; or the Exceſs above Ten, or Tens, and carry 1 for every 10, as aforeſaid: And when you come to the laſt Figure of the Multiplicand, ſet down the whole Product of that Figure. Theſe Directions are fully demonſtrated by the Example following.

Multiply 8752 Multiplicand
By 5 Multiplier

43760 Product

After the Example is ſet down as before directed, with a Line drawn underneath, I begin at the right hand ſaying 5 times 2 is 10; and it being juſt 10, and nothing over or under, I ſet down 0, and carry

1 to the next; then 5 times 5 is 25, and 1 that I carry is 26; I ſet down 6 and carry 2 for the two Tens, then 5 times 7 is 35, and 2 that I carry is 37, I ſet down 7, and carry 3; laſtly, 5 times 8 is 40, and 3 that I carry is 43, which being the laſt Product I ſet it down as above directed: So the whole Product of 8752, multiply'd by 5, is 43760; that is, 5 times 8752, is 43760, as you may prove by Addition, ſetting down 8752, 5 times, and adding them up; which ſhews (as was ſaid in the Definition) that Multiplication compendiouſly performs the Work of Additiou.

More Examples for Practice by a ſingle Figure.

Multiplicand	47962	275460	479692
Multiplier	4	6	7
Product	191848	1652760	3357844

459240	7420067
8	9
3673920	66780603

When there are more Mulipliers than one, there muſt be ſo many particular Products to find out the whole Product; that is, each Factor muſt have its own Product, ſet down in due form, by one remove towards the left hand, (after the Product by the firſt Figure) then the ſeveral Products are added together, which Total is the whole, or general Product, or Reſult. As in this Example.

Multiply	479620
By	789
The ſeve-ral Pro-ducts {	4316580 3836960 3357340
The whole Pr.	378420180

In this Example I begin at the place of Units ſaying, 9 times 0 is 0, and 9 times 2 is 18, 8 and carry 1, and 9 times 6 is 54 and 1 I carry is 55, &c; and the firſt Product by 9 the firſt Figure is 4316580. Then I begin with 8 the ſecond Figure in the Multiplier, ſaying, 8 times 0 is 0, which I ſet down juſt under the multiplying Figure and 8 times 2 is 16, 6 and carry 1, and 8 times 6 is 48, and 1 I carry is 49, 9 and carry 4, and 8 times 9 is 72, and 4 is 76, &c. and the ſecond Product by the Figure 8, is 3836960. Laſtly I multiply the whole Multiplicand by the Figure 7, and the Product by that is 3357340, which three Products added together make 378420180 for the whole Product of 479620 multiply'd by 789. See the Work.

To multiply by 10, 100, 1000, &c.

Obſerve how many Cyphers there are in the Multiplier, annex thoſe Cyphers to your Multiplicand; and your Work is done.

45768	54321	47659
10	100	1000
457680	5432100	47659000

To

To multiply by 30, 40, 50, 600, *&c.*

Multiply by the Figures aud annex the Cyphers, or ſet down the Cyphers firſt, then multiply by the Figures.

Examples.

3721	4777	6789	45678
30	40	50	600
111630	191080	339450	27406800

To multiply by 11, 12, 110, 120, 1100, 1200, *&c.*

Multiply by 11 or 12, ſo as to have the Product in one Line, and then annex the Cypher or Cyphers; as in theſe Examples.

2476	5796	4625	5765
11	12	110	120
27236	69552	508750	691800

74562	4794
1100	1200
82018200	5752800

To multiply by a mixt Number, that is, a whole Number with a Fraction belonging to it, as $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{2}{3}$, *&c.*

Multiply firſt by the whole Number, and then take $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{2}{3}$, *&c.* of the Mnltiplicand, and add that, and the Product by the Whole Number, together.

Ex-

Pieces
24
Each 9 Yds $\frac{1}{4}$

216
$\frac{1}{4}$ of 24 6

Yards in all 222

Barrels.
252
Each 2 C. $\frac{1}{2}$

504
$\frac{1}{2}$ of 252 126

Hund. in all 630

Bags
119
Each 4 C. $\frac{3}{4}$

476
$\frac{3}{4}$ of 119 $\left\{ \begin{array}{l} 59\ \frac{1}{2} \\ 29\ \frac{3}{4} \end{array} \right.$

C. 565 $\frac{4}{4}$

Casks
26
Each 3 C. $\frac{2}{3}$

78
$\frac{2}{3}$ of 26 $\left\{ \begin{array}{l} 8\ \frac{2}{3} \\ 8\ \frac{2}{3} \end{array} \right.$

C. 95 $\frac{1}{3}$

Peices
424
Each 24 E $\frac{1}{5}$

1696
848
$\frac{1}{5}$ of 424 $\left\{ 84\ \frac{4}{5} \right.$

10260 $\frac{4}{5}$

Examples for Practice.

15257879
5400302

30515758
457736370
6103151600
76289395

82397154479458

50710984
4050607

354976888
3042659040
2535549200
2028439360

205410266767288

Ex. 3. If 63 Gallons make 1 Hogshead, how many Gallons in 80 Hogsheads ?
63

Anſwer, 5040 Gallons.

The

The Proof of Multiplication.

Multiplication may be prov'd by multiplying the Multiplier by the Multiplicand; and if the Figures prove the ſame, as by multiplying the Multiplicand by the Multiplier, you may conclude it right. Or according to the ſchool Method, by caſting out the Nines out of the Multiplier, and ſetting the overplus on the left ſide, of the X, made for the Proof, then the Nines are caſt out of the Multiplicand, and the overplus ſet on the right ſide, then thoſe two Figures are multiply'd into each other, and the Nines (if any) are caſt out of that Product, and what remains is ſet on the Top of the Croſs. Laſtly, the Nines are caſt out of the whole Product, and if the remaining Figure agrees with the Top, the Work is judg'd right and 'tis ſet at the bottom of the Croſs.

Example.

```
  5678       3
    24     6 X 8 Proof.
  ----
 2 712       3
11356
------
136272
```

What may be ſaid in favour of this Method of Proof is, that when a Sum is done right, it never appears wrong by this Way; but it too often makes Sums appear right when they are notoriouſly falſe. But the ſureſt rule of Proof, is by Diviſion, and till that is learnt, the other is made Uſe of.

CHAP.

CHAP. V.

DIVISION.

D*IVISION* teaches us to know how often one Number is contain'd in another; or how to divide a Number into what Number of parts we pleaſe. In this Rule there are three Members real, and a fourth Accidental, *viz.*

Viz. 1. The *Dividend*, or Number to be divided.
2. The *Diviſor*, or Number by which you divide.
3. The *Quotient*, or Number that ſhews how often the Diviſor is contain'd in the Dividend.

☞ *Note*, Always the Remainder is leſs than the Diviſor, or the Work is falſe.

***Dic quot*, *multiplica*, *ſubduc*, *transferque ſecundum*.**

A General Rule.
1. Seek. 2. Multiply. 3. Subtract.

Example 1. Divide 4724 Pounds into 4 equal Parts. To do this, ſet down the Number with the Diviſor before it in a Semicircle thus, 4) 4724, then draw a Line under it, and ask how oft 4 the Diviſor in 4 the firſt Figure in the Dividend, which is once, which I ſet under the Line thus:

4) 4724
―――――
1

Then once 4 is 4, from 4, and there remains 0, then how many times 4 in 7 ? once, which is ſet under the Line likewiſe thus :

4) 4724

11

Then once 4 is 4, from 7 and there remains 3, which ſuppoſed to ſtand before the 2 in the Dividend makes it 32 ; then the Fours in 3 2 ? *Anſwer* 8 times, which ſet under the Line alſo thus ;

4) 4724

118

Laſtly, how many times 4 in 4, once ; then once 4 is 4 from 4, and there remains nothing, and the Work is done, and ſtands thus ;

4) 4724

Quotient 1181

And ſhews that 4 is contain'd in 4724 *juſt* 1181, and nothing remains, or 4724 Farthings divided by 4 quotes 1181 pence for Anſwer.

Ex. 2. A ſecond Example may be this ; Divide 247962 by 7 ; having ſet down the Example as above, I proceed according to the above general Rule

Diviſor 7) 247962 Dividend

Quotient 35423---1 Remainder,
7

247962 *Proof.*

First I ſeek how oft 7 is contain'd in 2, the Anſwer is 0, but I muſt not ſet down 0, in the firſt place; (tho' at other times) becauſe in natural Numbers, 0 on the left hand of ſignificant Figures, neither increaſes nor diminiſhes the Number; wherefore if you can't have the Diviſor out of the firſt Figure of the Dividend, take it out of the two firſt Figures; as here, I ſay how many times 7 in 24? the Anſwer is 3 times, wherefore I ſet down 3 directly under the 4 in the Dividend (becauſe I do not take the Diviſor 7, out of 2, but out of 24) then according to the general Rnle, I multiply, ſaying 3 times 7 (the Diviſor) is 21, which I ſubtract from 24, and there remains 3, which being three Tens; make the next Figure 7, to be 37, then the ſevens in 37, is 5 times, 5 times 7 is 35, from 37 and there remains 2. then the ſevens in 29, 4 times; 4 times 7 is 28, from 29 and there remains 1, then the ſevens in 16 twice; twice 7 is 14, from 16 there remains 2. Laſtly, the ſevens ſevens in 22, 3 times, 3 times 7 is 21 from 22 and 1 is the remainder; and the Work done. So 7 is contain'd in 247962, 35423 times and 1 over. For the Proof, I multiply the Quotient by the Diviſor 7, taking in the remainder 1, and the Product correſponds exactly with the Dividend; wherefore I juſtly conclude the Diviſion truly wrought, ſee the Operation.

More

More Examples.

Dividend
Diviſor 3)45678 4)275060 5)3972460

Quot. 15226 68765 794492

6)479620 7)987654

79936--4 Rr. 141093--3

Diviſor 8)93176542

Quotient 11647067--6 *Remainder.*
8

Proof 93176542

As in Multiplication, for Expedition, you multi-ply'd by 11 and 12, *&c.* to have the Product in one Line; ſo in this Rule, for the ſame reaſon you are to divide by 11 and 12, *&c.* as by a ſingle Figure; as in the ſubſequent Examples.

11)34567 12)54321 11)47621 12)79620

3142-5 4526-9 4329-2 6635

Contractions in Diviſion.

When the Diviſor hath one, or more Cyphers, on the right hand, cut them off by a down right ſtroke

on

of the Pen, thus 1|00 or by a Comma thus 4,00; and likewiſe daſh off as many Figures or Cyphers from the Dividend thus; 4,00)724,02 (and what you ſo cut off, is the remainder or Part of it. So that if you divide by 10, 100, 1000, *&c.* only ſeparate ſo many Figures or Cyphers from the right of the Dividend, and the Work is done. The Figures towards the left hand is the Quotient, and thoſe towards the right are the Remainder.

Example.

1,0)39,5	1,00)749,60	1,000)597,860
10	100	1000

Or if you have ſignificant Figures, that do divide, and Cyphers belonging to them, for a diviſor cut off the Cyphers in the Diviſor, and as many Figures or Cyphers from the dividend, and then divide the remaining Figures of the dividend, by the remaining Figures of the Diviſor. As in theſe Examples.

3,0)3756	6,00)79942,00
125--6	12823- 4

Diviſion by two or more Figures, is accounted the hardeſt Leſſon in Arithmetick, yet I will endeavour to make that ſeemingly hard Taſk, plain, ſmooth and eaſy, to the meaneſt Capacity; and firſt it is neceſſary to obſerve the following plain and eaſy Heads, or Notes for the Rule of Working, *viz.*

1. So many Figures, or Places, as are in your Diviſor, you muſt point out ſo many in your Dividend, for your firſt Dividual, except the firſt Figure of

your Diviſor exceed, the firſt of your Dividend, then you go a Figure farther, towards the right hand, and make your Point there; ſo then your Dividual mark'd out hath a Figure more than your Diviſor, and then the firſt of your Diviſor is taken out of the two firſt Figures of your Dividual.

2. You never place a Cypher in the Quotient the firſt time you take (as was ſaid before) the Diviſor out of the Dividend.

3. You never exceed 9, in the times you take the Diviſor out of the Dividual.

4 The Dividual never exceeds the Diviſor above one Figure.

5. You never bring down but one Figure or Cypher at a time out of the Dividend.

6. For every Figure or Cypher brought down from the dividend, there muſt be one Figure or Cypher plac'd in the Quotient.

7. When you cannot take the Diviſor out of the Dividual, you muſt put a Cypher into the Quotient, and bring down another Figure, and if you cannot do neither, you muſt place another Cypher, *&c.*

8. When at any time after Subtraction there remains 0, and there remain nothing in the Dividend but Cyphers, you muſt then put them in the Quotient, as part of it, and the Work is done.

Divide 47932 by 38, after the Sum is ſet down for working thus —— I begin according to the general Rule, and ſeek 38)47932(how oft I can take 3. the firſt Figure of the Diviſor, out of 4 the firſt Figure of the dividend? And the Anſwer is once; wherefore I ſet down 1 in the Quotient, and then the Work ſtands thus;

38)47932(1
  .

And having made a Point under 7 for a dividual, according to the ſecond Article in the general Rule, I multiply the diviſor by 1 the Figure plac'd in the quotient, ſaying, once 8 is 8, which I put juſt under 7 (where the point is) in the dividend, and once 3 is 3, which I place under 4 in the dividend, and then the Work appears thus,

```
38)47932(1
   .
   38
```

And 38 ſtands in form to be ſubtracted from 47; wherefore according to the laſt Article in the ſaid general Rule, after having drawn a ſhort Line, I ſubtract, ſaying, 8 from 7 I cannot, but 8 from 17 and there remains 9; then 1 that I borrow'd, and 3 is 4, from 4, and there remains 0, but I do not ſet it down, becauſe it's the laſt place; and Cyphers towards the left-hand, in whole Numbers, ſignify nothing, and then the Work ſtands thus:

```
38)47932(1
    ..
   38
   --
    9
```

Then I make a point under 9 the next figure of the dividend (which point is a ſign of the figure's being brought down) ſetting it on the right of the remainder 9, and then I have 99 for a new dividual; then I ſeek again, and aſk how oft 3 the firſt figure in the diviſor, can be had in 9, the firſt figure in the dividual, 99? the Anſwer is 3 times; but before I ſet down 3 in the quotient, 'tis neceſſary to try whether it will go ſo many times, to prevent blots by alteration of figures, wherefore I multiply the diviſor by 3, for tryal, and ſay 3 times 8 is 24, 4 and carry 2, (which I do in my Mind, and not ſet it down) and 3 times 3 is 9, and 2 is 11, now 11 cannot be taken out of 9, wherefore I take a Unit, or 1 leſs, and place 2 in the Quotient, and multiply the Diviſor by it, ſaying, twice 8 is 16, 6 and carry 1, and twice 3 is 6, and 1 is 7, and then the Work ſtands thus:

```
38)47932(12
    ..
   38
   --
    99
    76
   --
    23
```

Then after a Line drawn I ſubtract, ſaying, 6 from 9, reſt 3, and 7 from 9, remains 2; then I make a point uneer 3 in the dividend, and bring it down, and ſet it on the right of the remainder 23, then I have 233 for a dividual, and the Work appears thus:

```
38)47932(12
    ..
   38
   --
    99
    76
   ---
   273
   228
   ---
     5
```

So I ſeek again, asking, how oft 3 the firſt of the firſt of the diviſor, in 23, the two firſt of the dividual? becauſe there is a Figure more in the dividual than in the diviſor, (which when ſo, is ever the practice) the Anſwer is, 7 times; but on tryal I find it will not go ſo many times, but finding it will bear 9 times, I ſet down 6 in the Quotient, and multiply by it, ſaying, 6 times 8 is 48, 8 and carry and 6 times 3 is 18, and 4 is 22, ſo that 228 ſtands under 233, for ſubtraction, which done the remainder is 5, as in the Example.

Laſtly, I make a point under 2, the only remaining Figure of the dividend, and ſet it on the right of 5 the remainder, and then there is 52 for the laſt dividual: Now I ask, how oft 3 in 5? (the Number of Figures, both of diviſor and dividual, being equal, *viz.* 2) the Anſwer is once; wherefore I put 1 in the Quotient, and multiply the diviſor 38 by it, which ſtill is but 38 (becauſe neither multiplies, or divides) which ſubtracted from 52 leaves 14 for the remainder; ſo the whole Work done, ſtands as beneath, and ſhews, that 38 is contain'd in 47932, 1261 times, and 14 over, which 14 is a Fraction, or 14 parts of 38.

```
38)47932(1261
   38...
   --
    99
    76
    --
    233
    228
    ---
      52
      38
      --
      14
```

***Ex.* 2. Divide 345678901 by 2345.**

```
2345)345678901(147411
     2345·····      2345
     ————         ————
     11117        737061
      6380       589644
     ————       442234
     17378 294822
     16415————
     ————345678901 Proof.
      9639————
      9380
     ————
      2590
      2345
     ————
      2451
      2345
     ————
     (106)
```

In the aforeſaid Example, firſt I take once, which ſubtracted as in the Work, leaves 1111, to which I bring down 7, and then I take 4 times, and multiply the diviſor by it, and it makes 9380, which ſubtracted according to Rule, leaves 1737, to which I bring down 8 from the dividend, then I ſeek again and find I can take 7 times, which I place in the quotient, and multiply the diviſor by 7, and it produces 16415, which ſubtracted from 17378, leaves 963, to which I bring down 9 from the dividend, and then I have 9639 for a dividual; then I ſeek again, and take 4 times, the diviſor multiply'd by it produces 9380, which taken from 9639, there remains 259, to which I bring down the 0 Cypher from the Dividend, and there is 2590 for a Dividual; ſo I ſeek again, and take once, which deducted from 2590, leaves 245, to which I bring down 1, the laſt Figure in the *Dividend*, and there is 2451 for the laſt Dividual, and I take once more, and place it in the Quotient, which taken from 2451, leaves 106 for a Remainder, and ſo the whole Operation is finiſh'd. Multiplying the Quotient by the Diviſor, taking in the Remainder, the Product is 345678901, the ſame Figures with the Dividend, which proves the Work right. And thus all Sums in Diviſion are done by repeating the aforeſaid general Rule of Seeking, Multiplying, and Subtracting, for every Figure or Cypher brought down from the Dividend, till the Whole is finiſhed, as is fully demonſtrated in the laſt Example, and further exemplify'd in theſe.

Example 3.

96,0)921408,1(9598
864 · ·

574
480

940
864

768
768

(1)

Example 4.

786)97645(124
786 · ·

1904
1572

3325
3144

(181)

In the 3d Example I ſeparate the 0 from the Diviſor 960, and likewiſe 1, the laſt Figure of the Dividend, and then divide only by 96, according to the foregoing Rules of Contraction; and in beginning the Work I find I cannot take 96 out of 92, wherefore I make a point under 1 for the firſt Dividual, and then I ſeek how oft 9 is contain'd in 92? in conformity to the firſt Head or Note, for the Rule of Working before-mention'd, *&c.*

The 4th Example is eaſy and obvious by the Work, to any Capacity, and therefore needs no Explanation. I ſhall now ſet down ſome Examples with their Quotients and Remainders, omitting the Operation, as a Touch-Stone to the Learner's Ingenuity.

Divide 123456789 by 29, the quotient is 4257130 and the remainder 19.

If you divide 7400690042 by 987, the quotient muſt be 749816620, and the remainder 260.

Again, divide 479679002742 by 4687; the Quotient is 102298784, and the Remainder 45566.—— And if you divide the ſame Number by 4200674, then the quotient will be 114190, and the remainder 4038682.

The Proof of Multiplication.

Is moſt infallibly done Diviſion, as was ſaid in the Rule of Multiplication; for if you divide the Product by the Multiplier, the quotient will be equal to the multiplicand; if ſo, the Work is right, otherwiſe not.

For tryal, we'll take the Example in Multiplication, which was prov'd by the Croſs, *viz.*

```
       5678
         24
      -----
      22712
     11356
     ------
24)136272(5678 Proof
   ....
   120
   ---
    162
    144
    ---
     187
     168
     ---
      192
      192
      ---
      (0)
```

So Diviſion is reciprocally prov'd by Multiplication, as in the ſecond Example of *Diviſion* by 2 or more Figures.

More Examples.

Ex. 1. Divide 5792 Pounds, equally among 8 Perſons, how much muſt each have to his Share ? Anſwer, 724 Pounds each.

Ex. Divide 8760 Hours (thoſe in a Year) by 24 (thoſe in a Day) how many Days in a Year ? *Anſw.* 365 Days.

Ex. 3. Divide 31680 ſuperficial ſquare Inches, (b 144, the Inches in a ſuperficial ſquare Foot, and tell me how many ſquare Feet there are in them.

Anſwer. 220 ſquare Feet.

Ex. 4. Divide 93311 ſolid Inches by 1728, the Inches in a ſolid Foot, and tell me the ſolid Feet in that piece of Timber that contains thoſe Inches?

Anſwer, 54 ſolid Feet.

CHAP. III.

REDUCTION.

IS an Application of Multiplication and Diviſion, ſhewing how to reduce Numbers of one Denomination to another; thereby diſcovering the ſame Value, tho' in different Terms.

As firſt, All great Numbers are brought into ſmaller by Multiplication; as Pounds into Shillings, Pence and Farthings, by multiplying by 20, 12, and 4; or Hundreds Weight into Pounds Weight, by multiplying by 4, and then by 28; or lower into Ounces, and Draws, by multiplying by 16 and 16.

Secondly, On the contrary, all ſmall Names are brought into greater by Diviſion, as Farthings into Pounds, by dividing by 4, 12, and 20; and Pounds Weight into Hundreds Weight, by dividing by 112, or by 28, and 4, and Drams into Pounds, by dividing by 16 and 16.

But the following Tables will be very uſeful for the eaſy reducing any thing of one Denomination to another.

Money.

Money.

In a Pound, or 20 *s.* are,	1	Mark and half
	2	Angels
	3	Nobles
	4	Crowns
	8	Half Crowns
	20	Shillings
	40	Sixpences
	60	Groats
	240	Pence
	960	Farthings

Avoirdupoiz Wt.

In a Tun are,	20	C.
	80	Quarters
	2240	℔
	35840	Oz
	573440	Drams
In a C. Wt.	112	℔
	1792	Oz.
	28672	Drams
In a ℔	16	Ounces
	256	Drams

Troy-Weight.

In a Pound, or 12 Ounces, are, 12 *Oz.* 240 *dwt.* 5760 Grains.

Apothecaries Weight.

In a ℔ are, 12 *oz.* 96 Drams, 280 Scruples, 5760 Grains.

☞ Note, 1 ℔ *Avoirdupoiz, is equal to* 14 *Oz.* 12 *dwt. Troy. and* 1 ℔ *Troy is equal to* 13 *Oz.* 2 *Drams and a half Avoirdupoiz.*

Long Meaſure.

In a Mile are, 8 Furlongs, 320 Poles, 1760 Yards, 5280 Feet, 63360 Inches, and 190080 Barley-Corns.

In a Furlong are, 40 Poles, 220 Yards, 660 Feet, 7920 Inches, and 23760 Barley-Corns.

☞ *Five Eeet is a Geometrical Pace.*

Dry Meaſure.

In a Laſt are, 2 Weys, 10 Quarters, 80 Buſhels, 320 Pecks, 640 Gallons, and 5120 Pints.

In a Wey are, 5 Quarters, 40 Buſhels, 160 Pecks, 320 Gallons, 2560 Pints. 8 Buſhels 1 Quarter.

☞ *A Gallon is* 272 *ſolid Inches and a quarter.*

Wine

Wine Meaſure.

In a Tun are, 2 Butts or Pipes, 4 Hogſheas, 6 Tierce. 252 Gallons, 504 Pottles, 1008 Quarts, 2016 Pints.

In a Pipe or Butt, 2 Hogſheads, 3 Tierces, 126 Gallons, 252 Pottles, 504 Quarts, 1008 pints.

Beer Meaſmre.

In a Barrel 2 Kilderkins, 4 Firkins, 36 Gallons, 72 Pottles, 144 quarts, 288 pints.

Ale Meaſure.

Iu a Barrel 2 Kilderkins, 4 *Firkins*; 32 Gallons, 64 Pottles, 128 quarts, 256 pints.

☞ *The Beer and Ale Gallon are the ſame,* viz. 282 *ſolid Inches, but the Beer Barrel is greater than the Ale Barrel by* 1128 *ſolid Inches, or* 4 *Gallons.*

In a Hogſhead, 1 Tierce and a half, 63 Gallons, 126 pottles, 252 quarts, 504 pints.

In a Tierce, 42 Gallons, 84 pottles, 168 quarts, 336 pints.

☞ *The Wine Gallon contains* 231 *ſolid Inches by which all Liquids are meaſur'd, except Beer and Ale.*

MONEY.

Example 1.

Reduce 348 lb into Shillings, Pence and Farthings?
20 Shillings 1 Pound.

6960 Shillings in 348 lb.
12 pence 1 Shilling.

83520 Pence in 348 lb.
4 Farthings 1 penny.

334080 Farthings in 348 lb.

In this Example there is a greater Denomination to be brought into a leſſer, which, according to the foregoing Rule, is done by Multiplication; wherefore I multiply 348 *l.* by 20, to bring them into Shillings, and the Shillings by 12, to bring 'em into pence; and laſtly, the Pence by 4, to bring 'em into Farthings; as in the Example.

(4
Ex. 2. In 334080 Farthings, how many Pence,
12) 83520 Pence. Shillings, and
2,0 696,0 Shillings. Pounds?
l. 348

This Example requires a ſmall Name to be brought into a greater, done by Diviſion, according to Rule in the definition of Reduction, (which is the reverſe of the firſt Example, and ſerves for its

Proof; for Reduction aſcending and deſcending, mutually prove each other, as Multiplication and Diviſion do, becauſe wrought by 'em) wherefore I divide the Farthings by 4, to bring them into Pence, and the Pence by 12, to bring them into Shillings; and the Shillings by 20 to bring 'em into Pounds.

N. B. In dividing by 20, I ſeparate the 0, from it, and likewiſe the Cypher from the Dividend, and then halve the Figure towards the left hand (which is the ſhorteſt way of dividing by 20) ſaying, The half of 6 is 3, and the half of 9 is 4, and there remains one Ten, which makes the 6, 16; then the half of 16 is 8, and is *l.* 348 as in the Work.

```
            l.   s.  d.
Ex. 3. In 476,  15, 6 ¼. how many Farthings?
           20
       ------
         9535
           12
       ------
       114426
            4
       ------
       457707 Farthings.
       ------
```

In this Example I multiply by 20, and take in the 15, ſaying, 6 is 0, but 5 is 5; then twice 6 is 12, and 1 (in the 15 being taken in, in the place of Tens) is 13, 3 and carry 1, and twice 7 is 14, and 1 is 15, 5 and carry 1, and twice 4 is 8, and 1 is 9: So that in *l.* 476, 15, there are 9535 *s.* which I multiply by 12, and take in the 6 Pence, ſaying, 12 times 5 is 60, and the 6 pence is 66, 6 and carry 6, and 12 times 3 is 36, and 6 is 42, 2, and carry 4, and 12 times 5 is 60, and 4 is 64, 4 and carry 6, and 12 times 2 is 108, and 6 is 114, which I ſet down, and ſhews that in *l.* 476, 15, there are 114426 Pence; which laſtly I multiply by 4, and take in the three Farthings, ſaying, 4 times 6 is 24 and 3 is 27, 7 and carry 2, and 4 times 2 is 8, and 2 is 10, 0, and carry 1, and 4 times 4 is 16, and 1 is 17, 7 and carry 1, and 4 times 1 is 4 and 1 is 5; and 4 times 1 is 4: So the Work is done, and ſhews that in *l.* 476, 15, 6 ¾. there are 457707 Farthings.

Ex. 4. In 457707 Farthings, how many Pounds?

```
     (4
      457707
      ------
  12)114426-¾
     --------
   2,0 953,5-6 d.
       -------------
*Anſw.* l. 476, 15, 6¾.
```

This Example being a ſmall Name to be brought into a greater, it is done by Diviſion, and divided by 4, by 12, and by 20, gives 476 *l.* and 15 *s.* 6 *d.* ¾. remain in their proper places as they were taken in, and is a Proof to the 3d Example, as that (if this had been done firſt) might be to this.

Examples for Practice.

5. In 47969 *l.* 19 *s.* 8 *d.* ½. how many Farthings?
Anſwer, 46051186 Farthings.
6. In 4554929 Farthings, how many Pounds, &c.
Anſwer, *l.* 4744, 14, 4 ¼.
7. In 4276 *l.* 12 *s.* 9 *d.* how many Pence?
Anſwer, 1026393 Pence.
8 In 10318080 Half-pence, how many Pounds?
Anſwer, 21496 *l.*

COINS.

In Reduction of *Coins*, the ſeveral Species muſt be of one Name; that is, the Dividend and Diviſor are to be of one Kind, *viz.* both Pence, both Shillings, both Farthings, or Half-pence; Divide the greater by the leſſer Number, and the Quotient will be the Anſwer: And Reurainder will be of the ſame Name with your Dividend, or Diviſor, for they are to be both alike.

Ex. 1. In 357 *l.* 14 *s.* 6 *d.* how many Dollars at 4 *s.* 6 *d*? Anſ. 1589

```
   357 l. 14 s. 6 d.
    20              4 s. 6 d
   ----             12
   7154            ----
    12              54
  ------           ----
54)85854(1589
   54...
   ---
   318
   270
   ----
    485
    432
    ----
     534
     486
     ----
     (86)
```

Here *l.* 357, 14, 6 Sterling, is brought into pence and make 85854 pence for a Dividend, and likewiſe, the Dollar ; and it makes 54 pence for a Diviſor ; which agreeable to the foregoing Rule of *Direction*, are both of one Name, to wit, *Pence*, which divided according to Rule, quotes 1589 *Dollars*, and 46 *Pence* remain, (or 4 *s.*) the ſame Name with the *Dividend* and *Diviſor*, as in the Operation may be ſeen.

Ex. 2. In *l.* 357, 14, 6, how many *Ducats* at 3 *s.* 9 *d.* $\frac{1}{4}$? *Anſ.* 1897, $\frac{59}{181}$

```
         20
      -------
       7154
         12
      -------
      85854
          4
      -------
  181)343416(1897
      181...
      --------
      1624
      1448
      --------
       1761
       1629
      --------
        1326
        1267
      --------
        (59)
```

In this ſecond Example, both the Sterling Money, and Ducat are brought into Farthings, and then the greater, divided by the leſſer Number, and the Quotient is 1897 Ducats, and 59 Farthings remain, or 14 *d.* 3 farthings. See the Work.

Ex. 3. In *l.* 426, 12, 6, how many half-Crowns? *Anſw.* 3413. You may bring *l.* 426, 12, 6 into Pence, and divide by 20, the Pence in Half a Crown, or work ſooner, by multiplying by 8, the Half-Crowns ih in a Pound, and take in 5, the Half-Crowns in 12 *s.* 6 *d.*

Ex. 4. In 11083 Nobles, at 6 *s.* 8 *d.* how many pounds, *&c.* *Anſwer*, *l.* 3694, 6, 8. In this Example you multſply the Nobles by 80, the Pence in a Noble, and that brings them into Pence; which divide by 12, and by 20.

Ex. 5. In 31849, 06, 8 how many Marks at 13 *s.* 4? *Anſwer*, 4774. Bring the given Sum into Pence, and 13 *s.* 4 *d.* alſo into Pence, and divide the greater by the leſſer, and the Anſwer will be 47774.

Ex. 6. In 47774 Marks, how many Pounds, *&c.* *Anſw.* *l.* 31849, 6, 8. Work as in the 4th Example.

Ex. 7. In 1725, 19, 4, how many Florins, at 2 *s.* 2. *Anſw.* 15932. Work this according to the 5th Example.

Ex. 8. In 44556 Rix-Dollars at 4 *s.* 8, how many Pounds Sterling?

Anſw. *l.* 10396, 8, 0. Here work as in the 4th Example.

Ex. 9. In 1276 *Moyadores* at 26 *s.* 6, how many *Guineas* at 21 *s*? *Anſw.* 1610 $\frac{4}{21}$.

Multiply the Number of Moyadores by the Pence, in 26 *s.* 6. and then divide by the Pnnce in 21 *s.* and the Quotient will be the Anſwer aforeſaid.

Ex. 10. In 3721 *Livres* at 20 *d.* how many Pieces of *Eight* at 4 *s* 4? *Anſw.* 1431 $\frac{8}{52}$. Multiply by 20, and divide by 52.

AVOIR-

AVOIRDUPOIZE WEIGHT.

C. q. lb
Ex. 11. In 44, 3, 24 how many Pounds? *Anſw.* 5036.
4

179
28

1436
560

This is a great Name to be brought into a ſmaller, and therefore done by Multiplication, as in the Work.

Tuns	Multiply'd by	20	Produce	Hundreds Weight.
Hundreds		4		Quarters.
Quarters		28		Pounds
Pounds		16		Ounces.
Ounces		16		Drams.

And the contrary by Diviſion.

I multiply the 44 *C.* by 4, taking in the 3 Quarters, and the Product is Quarters; which Quarters multiply'd by 28, produces the Anſwer in Pounds, *viz.* 5036. as in the Work.

Ex. 12. In 52564 Pounds, how many Hundreds, *&c.*

Anſwer, 476 *C.* 1 Qr. 24 lb.

Divide the Pounds by 28, and then that Quotient by 4; or elſe the Pounds 53364, by 112, the Pounds in a *C* Weight!

☞ Always remember when you multiply, to take in the odd Money, Weight, Meaſure, *&c.* in their proper places; and when you divide, the ſame will be Remainders.

C. qrs. ℔.
Ex. 13: In 3175, 2, 14 how many Tuns, *&c.*?
Tuns, *C. qrs.* ℔.
Anſw. 158, 15, 2, 15.

Divide by 20, becauſe 20 *C.* make a Tun;

Tuns *C. q.* ℔. *oz. dr.*
Ex. 14. In 4724, 15, 3, 26, 13, 14, how many *D*rams?

Anſw. 270938 9022.

Multiply by 20, and take in the 15 *C.* then by 4, taking in the 3 *qrs.* then by 28, and take in the 26 ℔, and then by 16 and 16, taking in the Ounces and *D*rams.

C. qr. ℔.
Ex. 15. 316, 3, 24 of Tobacco, how many Boxes each? 75 ℔. ½.

Anſwer, 470 Boxes, and 30 ℔. over.

Bring the groſs Weight into Pounds, and multiply 'em by 2, which brings 'em into Half-Pounds, then bring the 75 ℔ ½ into Half-Pounds alſo; by multiplying the 75 by 2, and taking in the 1, that ſtands over the 2, and then divide the greater by the leſſer, And thus all *Queſtions* of this kind are done agreeable to the directions given in Reduction of Coins.

TROY-WEIGHT.

	lb	oz.	dwt.	gr.	
In	426,	06,	13,	12,	how many Grains?

Anſw. 2456964.

Pounds Ounces Penny-Wts.	multi- ply'd by	12 20 24	pro- duce	Ounce Penny-Wts. Grains.

The contrary by Diviſion.

In the 16th Example above, (becauſe it is a great Name to be brought into a leſſer) by 12, by 20, and by 24, agreeable to the Table of Quantity, taking in the odd Weight by the way, thus:

lb	oz.	dwt.	gr.
426,	06,	13,	12.
12			
5118			
20			
102373			
24			
409494			
204747			
Anſw. 2456964 Grains.			

Thus I think by this, and the foregoing Examples, I have fully ſhewn the Nature of *Reduction*; and its Uſes will be more particularly found in the ſeveral Rules of Arithmetick hereafter, as in the *Rule of Three*, &c.

Here follow ſome Queſtions promiſcuhuſly for the exerciſe of *Reduction.*

Ex. 17. In 988 Broad-Pieces, at 23 *s.* 6 *d.* how many *Jacobus's* at 25 *s.* ?

Anſw 928 $\frac{18}{25}$.

Ex. In 90 Guineas, and 9 Piſtols, the Guineas at 21 *s.* and the Piſtoles at 17 *s.* how many Pence ?

Anſw. 24516.

Ex 19. In 20835499 Drams, how many Hundred Weight? &c.

C. *qrs.* ℔. *oz.* *dr.*
Anſw. 726, 2, 20, 10, 11.

℔. *oz.* *dwt.* *gr.*
Ex. 20 In 426, 06, 13, 12, how many Grains ?

Anſw. 2456964.

Ex. 21. In 246 Ingots of Silver, each 4 ℔ and a half, how many Ounces ?

Anſw. 13284.

Ex. 22. What Quantity of Gold will make 676 Funeral Rings, each to weigh 3 *dwt.* 12 *Grains* ?

Anſw. 118 *Ounces*, 14 *Grains* ?

Ex. 23. In 20105 Ells *Flemiſh*, how many Ells *Engliſh*, and Yards ?

Anſw. 12063 *Ells*, 15078 ¾ Yards.

Ex. 24. In 19 Packs of Cloth, each Pack qt. 27 Pieces, and each Piece 25 Yards and a half, how many Ells *Engliſh* ?

Anſw. 10465 ½.

Ex. 28 In 420 Hogſheads, and 32 Gallons of Beer, how many Pints, if 54 Gallons make a Hogſhead ?

Ex. 29. In 215403 Pints of Wheat, how many Quarters, &c.

Ex.

qr. *b.* *p.* *g.* *qt.*
Anſw. 420, 5, 2, 1, 1.

Ex. 30. In 524 Laſts of Rape-ſeed, how many Buſhels?

Anſw. 41920.

Ex. 31. In 246 Years, how many Months Weeks and Days?

Anſw. 3198 Months, 12792 Weeks, 89790 Days, or 86790 Days, at 365 Days to the Year.

Of TARE, TRET, *&c.*

Groſs is the Weight of the Commodity with the Hogſhead, Caſk, Cheſt, Bag, Bale, Wrapper, or whatever elſe contains it.

Tare is an allowance for the Weight of the Hogſhead, Caſk, Cheſt, *&c.* or whatever elſe contains the Goods. Sometimes the *Tare* is at ſo much *per* C. Weight, as 14, 16, 18, or 24 ℔. *per* Hundred; at other times at ſo much *per* Bag, Bale, Cheſt, *&c.*

Trett is an Allowance of 4 ℔. *per* 104, to Freemen of *London*, for Waſte, Duſt, *&c.* on ſome ſort of Goods, as Tobacco, *&c.*

Clough, or Draught is an Allowance of 2 ℔ upon every Draught above 3 C. Weight. *Nett* Wt. is what remains, when all the Allowances are deducted.

Examples.

Ex. 1. In 54 Bags of Hops, containing Groſs 135 C. 2 *qrs.* 14 ℔. *Tare* 14 p. Bag, how many Hundreds Nett?

Anſw. 128 C. 3 *qrs.* 14 ℔.

Multiply the 54 Bags by 14, and the Product is 756 for the Pounds Tare, which divided by 112

the

gives 6 C. 3 quorters, and 14 for the Net Weight.

Ex. 2. In 15 Casks of Brimſtone, Weight 46 Hundred, 3 quarters, 12 pounds *Groſs*, Tare 8 ℔. how many Hundred Nett ?

Anſw. 43 C. 2 *qrs.* 2 ℔.

In this Example multiply the 46 C. by 8, and it gives 368, to which add 6 povnds for the three quarters, and it makes 374, which divide by 12, as before, and then ſubtract the Tare from the Groſs.

46, 3, 12
3, 1, 10

43, 2, 2 Nett.

Ex. 3. In 9 Fats of Copper, cont. *Groſs* 75 C. 1 *qr.* 24 ℔. Tare 8 pounds per Hundred, how many pounds Nett ?

Anſw. 7849.

Multiply 75 C. by 8, *&c.*

Ex. 4. In 131 C. 3 *qrs.* of Figs, Tare 12 ℔ per hundred, how many *Hundred* Weight ?

Anſw. 117, 2, 15.

Multiply 131 by 12, and add add 9 pound for the 3 quarters, *&c.*

Ex. 5. In 9 Casks of *Argol*, qt. Gr. 81 C. 1 *qr.* 17 Pound, Tare 14 Pound *per Cent.* how many C. Net ? *Anſw.* C. 71, 0, 26.
Multiply by 14, *&c.*

Ex. 6. In 25 Frails of Raiſins, each 1 C. ¼, Tare 4 Pound *p.* Frail, how many Hundred Nett ? *Anſw.* 30 C. 1 *qr.* 12 Pound.

Ex. 7. In 42 Bags of Pepper, qt. Gr. 136 C. 2 *qr.* 24 Pounds, Tare 5 lb. *per* Bag, and Trett 4 lb. *per* 104 lb. how many Pounds Nett ? *Anſw.* 14521 lb. and a half.

Ex. 8. In 6 Hogſheads of Tobacco, qt. Gr. 42 C. 3 *qr.* 12, Tare 602 lb. and Tret 4 lb. *per* 104 lb. how many Pounds Nett ? *Anſw.* 4037 Pounds.

In theſe two laſt Examples the Groſs Weight muſt be reduc'd into Pounds, and then the Pounds Tare deducted from the Pounds Groſs ; the remaining Pounds you muſt divide by 26, becauſe 4 times 26 makes 104, and the Quotient are Pounds Trett, which you muſt ſubtract from the Pounds reſt, and the remainder are Pounds Nett, as in the following Examples.

```
                   42,  3,  12
                         4
                      ------
26)4198(161            171
   26                   28
   ---                ------
   159                 1370
   156                 343
   ---                ------
    38                 4800 Pounds Groſs.
    26                  602 Pounds Tare.
   ---                ------
   (12)                4198
                        161 Pounds Trett.
                      ------
               Anſw. 4037 Pounds Nett.
```

If the Tare be 14 ℔. *per Ct.* take one 8th of the Groſs Wt. for the Tare, and ſubtract, *&c.*

If the Tare be 16 ℔. *p. Ct.* take one Seventh of the Groſs Weight for the Tare, *&c.*

If the Tare be 20 ℔. *p. Ct.* take firſt for 16, and for the 4 ℔. take one Fourth of that Quotient, and add 'em together.

Ex. 9. In 426 Barrels of Anchovies, each 29 ℔. and a half, Tare 7 ℔. *p.* Barrel, how many Pounds Nett? *Anſw.* 9585.

Ex. 10. In 4 Barrels of Rice, cont. 15 C. 2 *Qrs.* 16 ℔. Gr. Tare 120 ℔. Trett 4 *p* 104 ℔. and Clough 2 ℔. *p.* Barrel, how many Pounds Nett?
Anſw. 1562.

Ex. 11. In 14 Barrels of Capers, qt. 27 C. and a half, 19 ℔. Tare 35 *per* Barrel, how many Pounds Nett? *Anſw.* 2609.

Ex. 12. In 24 Barrels of Nutmegs, cont. Groſs 89 C. 3 *qrs.* 27, Tare 698 Pounds, and Trett 4 lb. *p.* 104 lb. how many Pounds Nett?

Anſw. 9020 lb. $\frac{1}{4}$.

Note. By making 14 and 16 your ſtanding Rules as above, they being aliquot Parts of 112 lb. you find the Tare at any Rate *p. Cent.*

CHAP. VII.

The GOLDEN RULE, *or, Rule of Three.*

THIS *Rule* is ſo called, becauſe therein are *three* Numbers given to find a *fourth* unknown, which ſhall bear ſuch a Proportion to the *third*, as the *ſecond* to the *firſt*; from whence alſo it is named, *The Rule of Proportion*, and for its excellent Uſe in *Arithmetick*, deſerves a *golden Name*.

The chiefeſt Difficulty ariſing is, the right ſtating, or due placing the three given Numbers for working, which may be eaſily done by obſerving,

1. That of the 3 given Numbers, 2 of 'em are always of one Denomination, or Name, *viz.* both Mony, both Weight, Time, or both Meaſure, *&c* and the other Number of a different Name, muſt always ſtand in the middle, and is always of the ſame Name with the Anſwer required; and unto one of the two Numbers of like Name, the Queſtion is annexed, which muſt be the third Number in the

ſtating; and then it cannot be difficult to know which muſt be the firſt, becauſe 1ſt and 3d Numbers muſt be of like Name, or ſo reduc'd; that is, if the 1ſt be Yards, ſo muſt the third; or if the firſt be Gallons, Feet, Inches, Farthings, Shillings, or Ells, ſo muſt be the third.---

2. In the next place, when your Queſtion is ſtated, you are to multiply the ſecond Number by the third, or the third by the ſecond (it being all one in conſequence) and divide the Product by the firſt Number, and the Quotient will be the fourth Number ſought, or Anſwer to the Queſtion, and is ever of the ſame Name you left the middle Number in; which, if in a low Denomination, muſt be brought higher, to the more ready comprehenſion of the Mind.

3. Sometimes it happens, that although the firſt and third Numbers are both of one Kind, that is, both Money, Weight, or Meaſure, *&c:* yet they may not be of one Denomination; or, peradventure, they may conſiſt of ſeveral Denominations, in which Caſe you muſt reduce both to one Name, as was ſaid above. And if the middle Number conſiſts of more than one Denomination, it muſt be brought to the loweſt mentioned; or lower, if you pleaſe.

4. When your Queſtion is ſtated, conſider with your ſelf, whether the 3d Number requires more or leſs than the ſecond: if more, then the leſſer of the two Extneams muſt be your Diviſor; but if leſs, then the greater of the two Extreams is your Diviſor: The firſt and third Numbers are call'd Extreams, with reſpect to the ſecond, or middle Number.

When { more } is requi- { leſſer } Extream is
{ leſs } red, the { greater } Diviſor.

Thus, by theſe two Words, *more*, or *leſs*, the Learner may diſtinguiſh when the Queſtion pertains to the *Rule of Three direct*, and when to the *Rule reverſe*.

5. When the firſt Number is the Diviſor, the Proportion is call'd *Direct* ; but when the third Number is the Diviſor, it's call'd, *Inverſe*, or *Reverſe*.

Having premis'd theſe things, I ſhall exemplify the Rule by the Examples following, *viz.*

Ex. 1. If 5 Gallons of Brandy coſt 22 *s.* 6 *d.* what will 134 Gallons coſt ?

```
        22 s. 6 d.
        12
        ——
        270
        134
       ————
       1080
       810
      270
     ——————
   5)36180
    ——————
  12)7236
    ——————
   2,0|60,3
    ——————
   L. 30, 3   Anſw. L. 30, 3 s.
```

This Queſtion is propos'd, and lies ready ſtated to hand ; for the Demand is on 34 Gallons, and is the 3d Number, according to the firſt Note of Direction foregoing ; and that of the ſame Name, *viz.* 5 Gallons, is the firſt agreeable alſo to the ſaid ſtating; and then it cannot be difficult to know which muſt be the firſt, becauſe 1ſt and 3d Number muſt be of like Name, or ſo reduc'd; that is, if the 1ſt be Yards, ſo muſt the third; or if the firſt be Gallons, Feet, Inches, Farthings, Shillings, or Ells, ſo muſt be the third.---

2. In the next place, when your Queſtion is ſtated, you are to multiply the ſecond Number by the third, or the third by the ſecond (it being all one in conſequence) and divide the Product by the firſt Number, and the Quotient will be the fourth Number ſought, or Anſwer to the Queſtion, and is ever of the ſame Name you left the middle Number in; which, if in a low Denomination, muſt be brought higher, to the more ready comprehenſion of the Mind.

3. Sometimes it happens, that although the firſt and third Numbers are both of one Kind, that is, both Money, Weight, or Meaſure, *&c:* yet they may not be of one Denomination; or, peradventure, they may conſiſt of ſeveral Denominations, in which Caſe you muſt reduce both to one Name, as was ſaid above. And if the middle Number conſiſts of more than one Denomination, it muſt be brought to the loweſt mentioned; or lower, if you pleaſe.

4. When your Queſtion is ſtated, conſider with your ſelf, whether the 3d Number requires more or leſs than the ſecond: if more, then the leſſer of the two Extreams muſt be your Diviſor; but if leſs, then the greater of the two Extreams is your Diviſor: The firſt and third Numbers are call'd Extreams, with reſpect to the ſecond, or middle Number.

$$\text{When}\left\{\begin{matrix}\text{more}\\ \text{leſs}\end{matrix}\right\}\text{is requi-red, the}\left\{\begin{matrix}\text{leſſer}\\ \text{greater}\end{matrix}\right\}\text{Extream is Diviſor.}$$

Thus, by theſe two Words, *more*, or *leſs*, the Learner may diſtinguiſh when the Queſtion pertains to the *Rule of Three direct*, and when to the *Rule reverſe*.

5. When the firſt Number is the Diviſor, the Proportion is call'd *Direct*; but when the third Number is the Diviſor, it's call'd, *Inverſe*, or *Reverſe*.

Having premis'd theſe things, I ſhall exemplify the Rule by the Examples following, *viz.*

Ex. 1. If 5 Gallons of Brandy coſt 22 *s.* 6 *d.* what will 134 Gallons coſt ?

22 *s.* 6 *d.*
12

270
134

1080
810
270

5)36180

12)7236

2,0 60,3

L. 30, 3 *Anſw.* *L.* 30, 3 *s.*

This Queſtion is propos'd, and lies ready ſtated to hand ; for the Demand is on 34 Gallons, and is the 3d Number, according to the firſt Note of Direction foregoing ; and that of the ſame Name, *viz.* 5 Gallons, is the firſt agreeable alſo to the ſaid

Note; and the middle is Money, to wit, 22 *s.* 6 *d.* and of the ſame Name with the fourth Number ſought: For the Queſtion is, What Money will 134 Gallons coſt?

Firſt, I reduce the middle Number (becauſe of more Denominations than one, *viz.* Shillings and Pence) into one Denomination, to wit, Pence, according to the latter-part of the 3d Note, and they make 270 Pence, which I multiply by the 3d Number, 134, and the Product makes 36180; which, (according to the ſecond Note of Direction) I divide by the firſt Number 5, and the Quotient is, 7236, which are Pence, and of the ſame Name that the middle Number 22*s.* 6*d.* was reduc'd to; which being divided firſt by 12, and then that Quotient by 20, gives, or quotes, 30 *l.* 3 *s.* for the Anſwer, as in the Work.

Ex. 2. If 15 Yards of Silk coſt 48 *s.* what will 245 Yards coſt?

245 Yards.
48

1960
980

15)11760(784
105 — 39 *l.* 4 *s.* *Anſwer.*

126
120

60
60

(0)

In this Example, the Queſtion alſo ſtands truly ſtated, according to Rule ; wherefore I only multiply the 3d Number by the 2d, the Product of which I divide by the firſt Number 15, and the Quotient is 784 Shillings, and is of the ſame Name with the middle Number, to wit, Shillings, 48 ; which Shillings divided by 20, according to the Rule in *Reduction*, gives 39 *l.* 4 *s.* as the above Example plainly makes out.

Yds. *s.* *yds*
Ex 3. If 245 of Silk coſt 784, what will 15 coſt ?

```
   784 s.          245)11760(48 s. Anſw.
    15                  980
  ------              ------
   3920                1960
   7 4                 1960
  ------              ------
  11760                 (0)
```

Here, in this Example, I multiply the 2d Number by the 3d, that the leſſer Number may ſtand undermoſt, and to avoid having ſo many Products, and then divid by the firſt, according to Rule, and the Quotient is 48 *s.* for the Anſwer, and is a Proof to the 2d Example.

Ex. 4. If 1 C. Weight of Dates coſt 4 *l.* 5 *s.* 2 *d.* what will 34 C. 3 qrs. 18 ℔. coſt, at that rate ?

Here the 3d Number has Pounds mention'd in it, wherefore 34 C. 3 qrs. 18 ℔. muſt be brought into Pounds, and the middle Number into the loweſt Name mention'd, according to the 3d Note ; and likewiſe the 1ſt Number muſt be ſet in Pounds, becauſe the 3d will be Pounds ; and ſtands ſtated thus :

lb. — l. s. d. — C. q. lb.

If 112 — 4, 5, 2 — 34, 3, 18

20 — 4

85 — 139

12 — 28

1022 — 1120

279

3910

1022

7820

7820

39100

(12

112) 3996020 (35678 Pence, because the middle No. is so

336....

2,0)297,3-2

636

560

Anſ. 148, 13, $2\frac{84}{112}$.

760

672

882

784

980

896

(84)

After reducing the 2d and 3d Numbers, the 3d is multiply'd by the ſecond, and that Product divided by the 1ſt, and the Quotient is Pence, which divided by 12, and by 20, gives *l.* 148, 13, 2 , $\frac{84}{112}$. for the Anſwer, as in the Operation may be ſeen.

Ex. 5. If 1 Gallon of Oyl coſt 9 *s.* 6 *d.* ½. what will 376 Gallons coſt?

12

114

4

458

376

2748

3206

1374

4)172208

12|43052

2,0)358,7--8 *d.*

L 179, 7, 8 *d.*

In this Example I cannot divide by my 1ſt Number, according to the Rule, becauſe 1 neither divides, or multiplies; but I conſider what Name the middle Number is reduc'd to, which here is Farthings, which I multiply by the 3d Number, and the Product is Farthings, which divided by 4, and that Quetient by 12, and the next by 20, gives *l* 179, 7, 8 for the Anſwer, as in the Work.---- After this rate, are all Queſtions work'd, and the Anſwer found, when the firſt Number is a Unit, and the 3d Number of the ſame Name.

Queſtions wrought by the Inverſe Proportion, are ſuch as theſe that follow.

Ex. 7. If 4 Men dig a Trench in 3 days, in what time will ſix Men do it? Anſw. in 2 days.

M. D. M.
If 4——3——6
3

6|12
Anſwer 2 days.

Here the more the Hands, the leſs the Time requir'd; wherefore the greater Extream is the Diviſor, which being the 3d Number, the Proportion is Inverſe according to the 5th Note.

Ex. 8. If 60 Yards of Serge of 3 Quarters wide, will Line a certain Number of Coats, how many Yds will Line the ſaid Coats, when the Serge is but half Yard wide? Anſ. 90 Yards.

qr. W. Yds. qr. W.
If 3——60——2
3

2|180

Yards 90 Anſ.

Here the Stuff being narrower, more Yards are requir'd, wherefore the leſſer Extream is Diviſor.

Ex. 9. If 100 *l.* principal in 12 Months gain 5 *l.* Intereſt, what Principal will gain as much in five Months? Anſ. 240 l.

Mo. *l.* Pr. Mo.
If 12——100——5
12

5|1200

240 *l.* Anſwer.

Here the Principal muſt be more, becauſe the Time is leſs; wherefore the leſſer Extream is Diviſor: And as in the 2 foregoing Queſtions, I multiply 1ſt and 2d Numbers together, &c.

Ex. 10. If a Half-peck Loaf weigh 9 ℔. when Wheat is 5 s. a Buſhel, what muſt it weigh when Wheat is 3 s. a Buſhel? Anſw. 15 ℔.

s. ℔: s.
If 5——9——3
5
——
3|45
——
15 ℔. Anſwer.

Here the Weight muſt be more, becauſe the Price is leſs.

Ex. 11. If I lend a Friend 75 *l.* for 6 Mo. on promiſe of doing me the like Kindneſs, but at my Need he can lend me but 50 l, how long may I keep the ſame as a ſufficient Recompence? Anſw. 9 Months.

l. Mo: *l.*
If 75——6——50
6
——
5,0) 45,0
——
9 Months, Anſwer.

Ex. 12. If a Carrier receives 4 l. 4 s. for the Carriage of 12 C. 120 Miles, how many Miles muſt he carry 5 C for the ſame Money? Anſwer, 288 Miles.

C. M. C.
If 12 —— 120 —— 5
12

5) 1440

Anſwer 288 Miles.

In theſe Queſtions, the third Term bears the ſame Proportion to the ſecond, as the firſt doth to the 4th.

Of Remainders.

When any thing remains, after you have multiplied your ſecond and third Numbers together, and divided by firſt, it is part of an Unit of the Quotient; the Value of which is thus found. — Multiply the Remainder by the Parts of the next inferior Denomination that are equal to one of the Quotient, ſtill dividing by the ſame Diviſor; as if the Quotient be Pounds, then multiply the Remainder by 20, and divide by the firſt Diviſor, and the Quotient will be Shillings; and then if any thing remain, multiply it by 12, and divide by the ſame Diviſor, and the Quotient will be Pence; and then if any thing remain, multiply by 4, *&c.*

Example.

If 9 C. of Sugar coſt 5 l. what will 16 C. coſt ?

```
              16
               5
           ------
            9|80
           ------
          l. 8..8
               20
            -------
             9|160
            ---------
Shillings 17—7
               12
            -------
             9|84
              --------
        Pence 9—3/4
                  4
               -------
                9|12
                 -----
                 1/4 2/9.
```

By this Operation it appears, that if 9 Hundred of Sugar coſt 5 *l.* 16 Hundred will coſt 8 *l.* 17 *s.* 9 *d.* Farthing.

Now follow various Queſtions for Practice, and trial of the Learner's Ability.

Ex. 13. If 28 lb. of Sugar coſt 15 s. 4 d. what will 18 C 3 qrs. 20 lb. coſt at that rate ?
Anſwer, *l.* 58, 00, 11 $\frac{1}{4}$ $\frac{20}{28}$.

Ex. 14. If a Quarter of Barley coſt 17 *s.* 4. what will 24 Quarters, 4 Buſhels, and 3 Pecks, coſt at that rate ?

Anſwer, 21 *l.* 6, 3 $\frac{1}{2}$.

Ex. 15. If a Hundred Weight Hops coſt 10 Pounds ten, I demand what coſt five Bags, each weighing two Hundred, one Quarter, and eighteen Pounds ?

Anſwer, *l.* 126, 11, 3.

Ex. 16. If 12 Yards 3 Quarters of Shalloon coſt nineteen Shillings, Ten-pence Half-penny, what will 387 Yards coſt at that rate ?

Anſwar, *l* 30, 3, 3.

Ex. 17. If half a Yard of Velvet coſt 16 Shillings and Fourpence, what will 19 Yards and a half coſt at that rate ?

Anſwer, *l.* 31, 17, 0.

Ex. 18. If one Yard of Cloth be valued at two Shillings, Nine-pence, how many Ells of the ſame may be bought for 219 Pounds, ten Shillings ?

Anſwer, 1276, $\frac{4}{5}$.

Ex. 19. Admit A owes B 296 Pounds, 17 Shillings, and compounds to pay ſeven Shillings and Six pence in the Pound, the Queſtion is, What muſt B receive for his Debt ?

Anſwer, *l.* 111, 6, 4 $\frac{1}{2}$.

Ex. 20. If B owes C 395 Pounds, eighteen Shillings, and compounds the Debt for 98 Pounds, nineteen Shillings, Six-pence, what doth he pay in the Pound ?

Anſwer, Five Shillings.

Ex. 21, How many Yards were in that Piece of Cloth that coſt *l.* 14, 12, 6, admitting the Yard to be valued at 7 *s.* 6 *d* ?

Anſwer, Thirty-nine Yards.

Ex. 22. If I have fifty Pounds *per Annum*, how much is due to me for 144 Days, at that rate ?

Anſwer, *l.* 19, 14, 6 $\frac{90}{365}$.

Ex. 23. If one Hundred Pounds in twelve Months gain 5 Pounds Intereſt, what will two Hundred and ſeventy-five Pounds, ten Shillings and Sixpence gain in the ſame time ?

Anſwer, *l.* 12, 15 6 $\frac{1}{4}$ $\frac{1}{5}$.

Ex. 24. In what Time will 75 Pounds gain 25 Pounds Intereſt, after the rate of 5 *per Cent. per Annum* ?

Anſwer, Eighty Months, or ſix Years and eight Months.

Ex. 25. What muſt I give for the Inſurance of *l.* 426, 12, at 5 Guineas *p Cent.* the Guineas at 21 *s* ?

Anſwer, *l.* 22, 7, 11.

Ex. 26. If my Share in a Ship be $\frac{4}{32}$ Parts, what is due to me for Freight, if the whole Freight of the Voyage amounts to *l.* 1266, 16 ?

Anſwer, *l.* 158, 07, 0.

Ex. 27 If a Silver Tankard, weighing forty-ſix Ounces, fifteen Penny-Weight 12 Grains, is bought at five Shillings and Four-pence *per* Ounce. what comes it to ?

Anſwer, *l* 12, 9, 5 $\frac{7}{12}$. or, $\frac{28}{48}$.

Ex. 28. How many Hundred Weight of Sugar, at 5 *d.* $\frac{1}{2}$. *per* lb. may I buy for 156 Pounds ?

Anſwer, C 60, 3, 3.

Ex. 29. What comes the Brokerage to of *l.* 419, 7, at Half *per Cent.*

Anſwer, *l.* 2, 1, 11, $\frac{3}{4}$.

Ex. 30. If I have an Eſtate of 500 *l.* *per An* what may I expend daily, and yet lay by 12 *l.* 15 *s.* *per* Month ?

Anſwer, Nineteen Shillings *per Diem*.

Ex. 31. If I buy A But of Mountain-Wine at wenty-eight Pound ten Shillings, and it chances to ak 12 Gallons, valued at 4 *s.* 6 *d.* *per* Gallon, what oth it ſtand me in a Gallon ?

Anſwer, 4 *s.* 11 *d.* $\frac{2}{4}$ $\frac{90}{128}$.

The

The Proof of the RULE *of* THREE.

THE *RULE of THREE* may be proved ſeveral Ways: As,

1ſt, By a contrary Stating, and Operation. As if 12 Yards coſt 36 *s.* what 9 Yards? Anſwer, 27 *s.* Then if 9 Yards coſt 27 *s* what 12 Yards? Anſwer, 36 *s.* Or,

2dly, If you multiply the 4th Number, or Anſwer by firſt, and the Product be equal to the Product of the ſecond and third Numbers multiply'd together, the Work is true, otherwiſe not. As here the Product of 36 multiply'd by 9, is 324, ſo is 27 the Anſwer, multiply'd by 12, the firſt Number, which ſhews the Work to be right.

But to prove a Queſtion belonging to the *Inverſe Proportion*, you muſt compare the Product of the ſeſecond multiply'd by the firſt, with the Product of the third, multiply'd by the 4th, and if they agree, the Work is right.

Example. If 6 Bricklayers build a Wall in 14 Days, in what Time will 8 do the ſame. Anſwer, In 10 Days and a half.

If

B D B
If 6 ——— 14 ——— 8
6
———
8|84
———
Days $10\frac{4}{8}$ equal to $\frac{1}{2}$.

Here 14 multiply'd by 6, produces 84; ſo doth 10 multiply'd by 8, and taking in the remainder 4, produce the ſame.

CHAP. X.

RULES of PRACTICE.

BEfore I treat concerning the Rules of plural Proportion, viz. *The Double Rule of Three,* I ſhall ſpeak relating to thoſe excellently uſeful, and moſt conciſe Rules, call'd, *Rules* of *Practice.*

1. When any Queſtion in the Rule of Three Direct, hath a Unit, or *1* in the firſt Place; that is, if the Queſtion ſays, If 1 Yard, Ell, Pound, Gallon, &c. coſt ſo much, what ſo many Yards, Ells, Pounds, Gallons, &c. ſuch Queſtion may be much ſooner done by ſome one of theſe Rules, which from their frequent Uſe among Tradeſmen and Merchants, are call'd Rules of Practice, as above.

2. The Rules of Practice are either when the Pri of the Integer (or thing) conſiſts of Farthings unde 4 ; of Pence, under 12 ; or of Shillings under 20.

It is neceſſary for the Learner before he proceed, to have theſe ſhort and eaſy Tables by heart.

Aliquot PARTS.

		Of a Penny.
1 Farthing	is	$\frac{1}{4}$
2 Farthings		$\frac{1}{2}$
3 Farthings		$\frac{3}{4}$

Of a Shil.		
4		
6	is	$\frac{1}{2}$
4		$\frac{1}{3}$
3		$\frac{1}{4}$
2		$\frac{1}{6}$
1$\frac{1}{2}$		$\frac{1}{8}$
1		$\frac{1}{12}$

Of a Pound.		
s. d		
10,0	is	[illegible]
6,8		[illegible]
5,0		[illegible]
4,0		[illegible]
3,4		[illegible]
2,6		[illegible]
2,0		[illegible]
1,8		[illegible]
1,0		[illegible]

The meaning of the Word *Aliquot*, is ſuch a Part of a Number, as being taken certain times, doth preciſely make the Number ; as 3 is an Aliquot Part of 12, 4 of 20, and 5 of 40, &c. that is, 3 is the 4th of 12 ; 4, the 5th of 20 ; and 5 the 8th of 40, &c.

RULES of PRACTICE.

I. *Of Farthings under Four.*

Conſider what Part of a *Penny* the Price is, and divide the Number of *Integers* by that Part; whether by 4, by 2, or by 8, and the *Quotient* is *Pence*, which divide by 12, *&c.* by 20, *&c.* as in the *Examples* following.

Ells.

¼ | ¼ | 4694 of *Holl.* Tape at ¼ *d.p.* Ell.

1*d* | $\frac{1}{12}$ | 1173 — 2

1*s.* | $\frac{1}{20}$ | 97 — 9

l. 4, 17 9 ½. *Anſwer.*

In this Example I divide, or take the 4th part of 4694, *and the Quot.* 1173 *is Pence, and* 2 *remains, which are* 2 *Farthings; for note once for all, Whatever remains, is ſtill of the ſame Name with the Dividend, as* 4694 *are Farthings, that is Ells at* 1 *Farthing apiece, wherefore the* 2 *that remains are* 2 *Farthings, or* ½ *d. then I take the* 12*th part of* 1173, *& it quotes* 97, *which are* 97 *Shillings, and* 9 *remains, which is* 9 *d.* (*becauſe* 1173, *the Dividend are Pence*) *laſtly, I take the* 20*th part of* 97, *or* (*according to the Rule in Reduction of bringing Shillings into Pounds*) *I ſeperate the laſt Figure to the right-hand*

hand, being 7, and halve 9, ſaying, the half of 9 is 4, which is 4 Pounds ; ſo that the Anſwer is, 4 l. 17 s. 9d. ½ as may be ſeen in the Work. If I had taken the 12th part of 4694, the Quotient would have been Threepences, which divided by 4, quote Shillings, &c.

	d	*Yds.*
½d	½ 1	4790 of *Incle*, at ½. *per* Yd.
1d	1/12	2395
1s.	1/20	19, 9, 7
		l. 9, 19, 7 *Anſwer.*

Here I ſay, the half of 4 is 2, and the half of 7 is 3, and the half of 19 is 9, and the half of 10 is 5 ; which thus dividing by 2, quotes 2395 Pence, which I bring into Pounds, as in the firſt Example.

Or if I had taken the 8th part of 4790 the Quotient w have been 598 Gr and 6 remaining Half-pence, eq 3d. then thoſe Gr divided by 3 w quote 199 Shil and one Groat, r maining, which and 3d make equal in Anſwer the other Work.

	d	*lb.*
¾	⅛ 6	8888 of *Sea-Bri* at 4 per
	s	
6d	½ 1	1111
		55, 5—6*d.*
	½ 0	
		l. 27, 15, 6 *Anſw.*

In this Example I take the 8th pa the given Number, becauſe 3 Farthings the 8th part of 6d. and the Quotient i Sixpences, &c.

	d	*Gallons.*
¼	¼ 1	796 at ¼ *p:* Gallon.
1d	1/12	199
	1s.	
		s. 16--7 *Anſ.* 16s. 7

Pounds.
4680 at ½ p. ℔.

780

19,5

l 9,15 Anſwer.

II. *Of Pence, under* 12.

TAke ſuch Parts of the given Number as they repreſent of a Shilling and the Quotient will be Shillings; which bring into Pounds as before.

℔.
$\frac{1}{12}$ 5728 Suffolk Cheeſe
1s. at 1 d. p. ℔.
$\frac{1}{2}0$ 47,7—4 *d.*

l 23, 17,4 Anſwer

s.
℔.
2*d* $\frac{1}{6}$ 1 7260 of Salt at 2d. p. ℔,
$\frac{1}{2}0$ 121,0

l.60, 10 Anſ.

---

oz.
3*d* $\frac{1}{4}$ 1 497 of Worſted at 3*d*. p. oz.
$\frac{1}{2}0$ 12,4, 3 *d.*

l 6, 4, 3 Anſw.

Yds.
4*d* $\frac{1}{3}$ 1 8934 of Ribbon at 4*d*. a Yd.
$\frac{1}{2}0$ 297,8

l 148, 18 Anſ.

℔.
3*d* $\frac{1}{4}$ 1 4569 of Candles at 5*d* a Pound.
2 $\frac{1}{6}$ 1 1142—3d.
5 761—6

1903 9

l 95, 3, 9 Anſ.

In this Example I take firſt for 3d, and then for 2 d. which make fivepence; wherefore I add the 2 Quotients together. The ſame Anſwer would have been, if I had taken firſt for 4d. and then for 1 d. After the ſame Method may Examples be done, if the Price be 7 d 9 d. or 10d. for 3d. and 4d. make 7d; 6d. and 3d. 9d. and 6d. and 4d. 10d.

	s.	℔
6d	1/2 1	4719 of Sugar at *6d.*
	1/20	2359—6
		l 117, 19, *6* Anſw.

		℔
4*d*	1/3 1	2383 of Bacon, at 7d.
		794— 4d.
3/7	1/4	595—9
	1/20	139, 0, 1
		l 69, 10, 1 Anſwer.

		℔
4*d*	1/3	46920 of Tobac at 8d. p.
		15640
4	1/3	15640
8		31280
1*s.*	1/20	*l* 1564 Anſwer.

		℔
6*d*	1/2	429 Loaf-Sugar 9d. p.
		214, 6
3/9		107, 3
1*s.*	1/20	32, 1, 9
		l. 16, 1, 9 Anſw

		℔
6*d*	1/2	3790 Tobacco 1
		1895
4/10		1263—4d.
1*s.*	1/20	315, 8, 4
		l 157, 18, 4 An

s. Yds.
6d ½ 845 Coventry Stuffs
at 11d. p. Yd.

4 ⅓ 422, 6
1 ¼ 281, 8
11 70, 5

77,4 7

l 38, 14, 7 Anſw.

III. *Of Shillings under* 20.

TAke ſuch Parts of the given Number, as the given Price in Shillings repreſent of a Pound, and the Quotient will be Pounds, &c.

☞ Note, That when the Price is 2*s.* only double the laſt Figure towards the Right-Hand for Shillings, and the other Figures to the Left are Pounds; As 246 Gallons at 2s. p. G. is *l.* 24, 12. 67 Ells at 2s. is *l.* 6 14 and 972 Yards at 2s. is *l.* 97, 4, &c.

s. ℔
4 ⅕ 7460 of Indigo, at 4 s p. ℔.
1492 *l.* Anſwer.

5 ¼ 7967 G. of Brandy, at 5s. p. Gal.
1991, 15 Anſwer.

4 ⅕ 4200 Gall. at 6s. p. Gal.
½ 840
420

l 1260 Anſ.

769 Yards at 8 s. a Yd.
4 ⅕ 153, 16
4 ⅕ 153, 16

l 307, 12 Anſwer.

Ells.
796 at 9 s. per Ell.

5 ¼ 199
4 ⅕ 159 4 s.

338, 4 Anſwer.

Or, if the Number of Integers are multiply'd by the *Shillings* in the Price and then halv'd to bring the Shillings into Pounds, it anſwers to the ſame Intent, as by taking Parts as above; and very ready for Diſpatch.

Example.

lb.
796 at 9 s. per lb.
9
716,4
$\frac{1}{2}$0 | *l* 358, 4 Anſwer as above.

IV. *Of Pence & Farthings, and of Shillings, Pence, & Farthings.*

1 *s.*
1 *d* | $\frac{1}{12}$ | 4264 lb. Tallow at 1 *d.* $\frac{1}{4}$ p.
$\frac{1}{4}$ | $\frac{1}{4}$
1 *d* | 355, 4
88, 10
$\frac{1}{2}$0 | 44, 4 2
l 22, 4, 2 Anſwer.

IN this Example I take $\frac{1}{12}$ of the given Number for the Penny, which quoteth 355 s. and 4 d. remains; then I conſider that $\frac{1}{4}$ is $\frac{1}{4}$ of a Penny, wherefore I take $\frac{1}{4}$ of 355 s. 4 d. (and not of the given Number 4264) and it quoteth 88 s. 10 d. thus I ſay, the 4's in 35? 8 times; and the 4's in 35? 8 times, and there remains 3 s. which is 36 d. and 4 d. taken in, makes 40 d. then the 4's in 40? 10 times; which 2 Lines added together, make 444 s. 2 d. or 22 l. 4 s. 2 d. as in the Work. And so of any other of this kind.

lb
1d $\frac{1}{12}$ 4269 at 1 d. $\frac{3}{4}$ per l.
d
$\frac{1}{2}$d $\frac{1}{2}$ 1 355—9 d.
$\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{2}$ 177, 10 $\frac{1}{2}$
88, 11 $\frac{3}{4}$
$\frac{1}{2}$ 0 62,2,7 $\frac{1}{4}$
l. 31,2,7 $\frac{1}{4}$ Answer.

After I have taken $\frac{1}{12}$ of 4269 for the Penny, I take the $\frac{1}{2}$ of that Quotient for the Halfpenny; and then the $\frac{1}{2}$ of that Line for the Farthing, &c.

s. lb
d $\frac{1}{2}$ 1 4900 Cheese at 2 d. $\frac{1}{2}$ per l.
d
$\frac{1}{2}$d $\frac{1}{4}$ 2 816—8 d.
204, 2
$\frac{1}{2}$ 0 102,0,10
l. 51,00,10 Answer.

s. lb
3d $\frac{1}{4}$ 1 579 dit. at 3 d. $\frac{1}{4}$ per l.
d
$\frac{1}{4}$d $\frac{1}{12}$ 3 144, 9
12, 0 $\frac{3}{4}$
$\frac{1}{2}$ 0 156, 9 $\frac{3}{4}$
l. 7, 16, 9 $\frac{3}{4}$ Answ.

6d $\frac{1}{2}$ 7093 lb Sug. at 7 d. $\frac{3}{4}$
d.
1d $\frac{1}{6}$ 6 3546, 6
591, 1
$\frac{3}{4}$ $\frac{1}{8}$ 6 443, 3, $\frac{3}{4}$
458,0,10,$\frac{3}{4}$
$\frac{1}{2}$ 0 l. 229,00, 10$\frac{3}{4}$ Anſ.

Three Farthings is $\frac{1}{8}$ of 6 d. wherefore I take $\frac{1}{8}$ of the 6 d. Line 3546, 6 ſaying, the 8's in 35? 4 tim. the 8's in 34? 4 tim. 8's in 26? 3 tim. and there remains 2 s. or 24 d. and 6 is 30, the 8's in 30?

30? 3 times; and there remains 6, or 24 Farthings, and the 8's in 24? 3 times, *&c.*

℔
6*d* ½ 757 of Tobacco at 9 d. ½
d.
3*d* ½ 6 378, 6
d. 189, 3
½ ⅙ 3 31, 6 ½
½ 0 59, 9, 3 ½
l. 29, 19, 3 ½ Anſ.

℔
3579 at 11 d. ¼ per l.
6*d* ½
d. 1789, 6
3 ½ 6 894, 9
2 ⅓ 6 596, 6
¾ ¼ 3 223, 8 ¼
350, 4, 5 ¼
l. 175, 4, 5 ¼ Anſw.

V. *Of Shillin* *Pence, a* *Farthings.*

MUltiply by t Shillings, take Parts for t Pence & Farthing

Ells
976 of Holland,
l.
2 :
3*d* *s.*
¼ 1 1952
d. 244
½ ⅙ 3 40, 8d.
223, 6, 8
l. 111, 16, 8 An

Yards
2728 of Mu
5 ſ8.
6*d* ½ *d* 13640
3 ½ 6 1364
682
d
¾ ¼ 3 170, 6
½ 0
1585, 6, 6
l. 792, 16, 6
Ga

Gallons
978 of Brandy at
7 7*s*.8*d*½ p.G.

4*d* 6846
½ 326
4 ⅓ 326
½ ⅛ 4*d* 40, 9

½0 753, 8, 9

l. 376, 18, 9 Anſw.

Yards
749 of Fine-Cloth at
16 16s.6d.½ p.Y.

4494
6*d* 749
½ ½ *d* 374, 6
1/12 6 31, 2½

½0 1238, 9, 8½

l. 619, 9, 8½ Anſ.

VI. *Of even Parts of a Pound.*

Conſider what Part of a Pound the Price is, and divide the given Number of Integers by it, and the Quotient will be Pounds.

s.d.
6,8 ⅓ l.

Gallons
9752 of Brandy at
6*s*. 8*d*. p. G.
l. 3250, 13, 4 Anſ.

I take ⅓ of 9752, and there remains 2, which is 2 ſix and eight Pences, or 13|4 ſo the Anſwer is, l. 3250, 13, 4

5 ¼ l.

lb
7261 of Indico at
5s. per l.
l. 1815—5 Anſwer.

4*s*. ⅕ l.

Ells
4720 of Holland at
4s. p. E.
l. 944 Anſwer.

s d.
3,4 ⅙ l.

lb
9720 of Cloves at
3|4 p. lb
l. 1620 Anſwer.

s.d. Yards
2,6 $\frac{1}{8}$ l. 719 of Silk at 2|6
l. 89, 17, 6 Anſw.

s.d. Gallons
1,8 $\frac{1}{12}$ l. 47690 of Oyl at 20d. per Gall.
l. 3974—3, 4 Anſ.

VII. *When the Price is Shillings & Pence and no even Part of a Pound.*

MUltiply the given Quantity by the Shillings in the Price, and take Parts for the Reſt. Or ſometimes the Price may be divided into even Parts and work'd that Way; as 12|6 is 10s. and 2|6 15| is 10s. and 5| &c.

Ells
579 of Holland at 3s. 2d. p. Ell.
3
1737
2d $\frac{1}{6}$ 1*s* 96—6
183, 3, 6
l. 91, 13, 6 Anſwer.

℔
76395 Indico at 4s. 5d. p.
4
305580
s.
3d $\frac{1}{4}$ 1 19098—9d,
2 $\frac{1}{6}$ 1 12732—6
$\frac{1}{2}$,0 33741, 1, 3
l. 16870, 11, 3 Anſ

℔
6942 at 9, 6
9
62478
s.
6d $\frac{1}{2}$ 1 3471
$\frac{1}{2}$,0 6594, 9
3297, 9, 0 Anſwer.

Quarters
976 of Oats at 9|9
9

8784
6d. $\frac{1}{4}$ 1 s. 488
3 $\frac{1}{2}$ 6d. 244

$\frac{1}{2}$,0 951, 6

475. 16 ,0 Anſw.

---

lb
798 of Scamoney
18 at 18s. 6d.

6384
6d. 798
$\frac{1}{2}$ 1 s. 399

$\frac{1}{2}$,0 1476, 3

738, 3, 0 Anſw.

The Price divided into Parts.

Gallons
205 of Tent 7|6 s. p. Gall.

5s. $\frac{1}{4}$ l. 51—5
s. d. $\frac{1}{8}$ 25—12, 6
2, 6
7, 6

l. 76, 17, 6 Anſ.

Gallons
1515 of Brandy at 8|4

5s.
s. d. $\frac{1}{4}$ l. 378—15
3, 4 $\frac{1}{8}$ 252—10
8, 4

l. 631, 5 Anſw.

---

lb
7496 of Tea at 12|6 p. lb

10 s. $\frac{1}{2}$ l. 3748
2, 6 $\frac{1}{4}$ 10s 937

l. 4685 Anſw.

French Crowns
4796 at 4|6

4 s. $\frac{1}{5}$ 959—4s.
6 d. $\frac{1}{8}$ 4 s. 119—18

l. 1079, 2 Anſ.

C
978 of Sugar at 17s.6d.

10 s. $\frac{1}{2}$ 489 :
5 $\frac{1}{2}$ 10s 244—10
2, 6 $\frac{1}{2}$ 5 s 122— 5
17,6

l. 855, 15 Anſ.

VIII. *If the Price be any Number of Pounds, Shillings, Pence; reduce the Pounds and Shillings into Shillings, and multiply the Quantity by the Shillings, & take Parts for the Pence, as before.*

C.
246 of Hops at l. 3,
67 7s. 6d. per C.

1722
s. 476
6d ½ 1 12, 3

1660, 5

l. 830, 5, 0 Anſw.

C.
537 of Almonds at
135 l. 6, 15, 4 p. C.

2685
1611
537
s. 179
4d ⅓ 1

7267, 4

3633, 14, 0 Anſw.

Pieces of Silk
75 at l. 8. 12s. 3d.
172

860
1204
s. 18, 9
3d ¼ 1

1291, 8

Here 72 is multiply'd by 75

l. 645, 18, 9 Anſ.

IX. *When the Price is above 1 Shilling, & under 2 Shillings, then let the given quantity stand as* *as Shillings; and without drawing a Line, take Parts for the Pence, or Pence and Farthings, &c add the ſeveral Lines together,* &c.

Ells
1279 of Dowlaſs at
13d. ½ per Yard.

s. d
1½ | ½ 1 | 159,—10 ½
½ 0 | 143,8,10 ½
l. 71, 18, 10 ½ Anſ.

Here 1279 Ells are ſhillings a-piece, of which I take ⅛

4d | s. | ⅓ | 3762 Gallons of Spirits at 16d p. Gall.
1254
5016
l. 250, 16 Anſwer.

Yards
s. | 4796 at 18d p. Yd.
6d | ½ 1 | 2398
½ 0 | 719,4
l. 359,14,0 Anſw.

Yards
97069 of Serge at
21d ½ per Yard.

s.
6d | ½ 1 | 48534, 6
3 | ½ 6 | 24267, 3
½ | ⅙ 3 | 4044, 6 ½
17391, 5, 3 ½
l. 8695,15, 3 ½ Anſ.

X. *If the given Quanty hath odd Weight or Meaſure annext to it.*

WOrk for the whole Number as before, and for odd Weight or Meaſure, take Parts of the given Price, accordingly, as, for ¼ take a quarter of the Price, & add it to the other Work; for ½ the Half, and for ¾ three Quarters of the Price, *&c.*

C.
256 $\frac{1}{2}$ of Rice at
15 15|6 p C.

1280
s. 256
6d $\frac{1}{2}$ 1 128 } the half of
7,9 } 15 s. 6 d.

3975, 9

l. 198, 15, 9 Answ.

65 Qrs. 5 Bush. of
32 Wheat at
3s. 6d. Qr.

130 B
195 4$\frac{1}{2}$ B | 16,3
6d $\frac{1}{2}$ 0 32,6 1 $\frac{1}{4}$ 4 | 4,0$\frac{3}{4}$
For the 5 Bush. 20, 3$\frac{3}{4}$
20,3$\frac{3}{4}$
213, 2, 9$\frac{3}{4}$

l. 106, 12, 9$\frac{3}{4}$ Anſ.

C. qrs. ℔
426, 2, 14 of Tar
33 (at l. 1, 13

1278 qr. $\frac{1}{2}$ 16, 6
1278 ℔. 14 $\frac{1}{4}$ 4, 1$\frac{1}{2}$
20, 7$\frac{1}{2}$
20, 7$\frac{1}{2}$
1407, 8, 7$\frac{1}{2}$

l. 703, 18, 7$\frac{1}{2}$ Anſ.

s. l.
10 $\frac{1}{2}$ 1

Tuns C. qr. ℔ Iro
46, 12, 3, 16
15 (at l. 15, 10

230 10 C $\frac{1}{2}$ 7, 15, 0
46 2 5 1, 11,
23
9, 19, 10 C $\frac{1}{2}$ $\frac{1}{4}$ 7, 9
C $\frac{1}{4}$ 2 3, 10
l. 722, 19 10 4 $\frac{1}{2}$ 1 11
2 ℔ $\frac{1}{7}$

l. 9, 19,

Gallons
976, 3 qrs of Brand
5 (at 5s. 7d. p. G

s. 4880
6d $\frac{1}{2}$ 488 $\frac{1}{1}$ 2, 9
d 81, 4 $\frac{1}{2}$ 1, 4
1 $\frac{1}{6}$ 6 4, 2$\frac{1}{4}$
4, 2
$\frac{1}{2}$ 0 545, 3, 6$\frac{1}{2}$

l. 272, 13, 6$\frac{1}{2}$ Anſ.

RULES of PRACTICE by MULTIPLICATION.

THERE is a moſt conciſe Way of caſting up the ſeveral Articles of Bills of Parcels, *&c.* by Multiplication, *viz.* by multiplying the Price by the Quantity, carrying from one Denomination to another, as in Addition of Money.

Ex. Seven Yards of Cloth, at 5|9 *per* Yard.
7

l. 2,00, 3 Anſwer.

Here I ſay, 7 times 9 is 63 *d.* 3, and carry 5*s.* and 7 times 5 is 35, and 5 is 40*s.* or 2 *l.* ſo the Anſwer is 2*l.* 0, 3*d.* as in the Work.

9 C of Hops, at *l.* 3, 05, 6, *per* C.
9

l. 29, 9, 6 Anſw.

In this Example I ſay, 9 times 6 is 54*d.* or 4*s.* 6*d.* I ſet down 6 and carry 4. and 9 times 5 is 45, and 4 is 49, I ſet down 9*s.* and carry 2*l.* then 9 times 3 is 27, and 2 is 29, ſo the Anſwer is, 29*l.* 9, 6, as in the Work.

9 pair of Hoſe, at 7*s.* 6*d.* *per* Pair.
9

l. 3, 7, 6, Anſwer.

11 Gallons of Wine, at 5*s.* 4*d.* *per* Gallon.
11

l. 2, 18, 8, Anſwer.

12 C. of Sugar, at 35*s.* 6*d.* *per* C.
12

---

l. 21, 06, 00, Anſwer.

In this Example I ſay, 12 times 6 is 72*d.* 0, and carry 6*s.* and 12 times 5 is 60, and 6 is 66, I ſet down 6*s.* in the place of Shillings, and carry 6 for the 6 Tens, then 12 times 3 is 36, and 6 is 42, or 42 Angels, the Half of which is 21, ſo the Anſwer is *l.* 21, 06, 00, as in the Operation.

When the Quantity exceeds 12, find two Numbers, which multiply'd together, will make the Quantity, then multiply the Price by one of the Numbers, and the Product of the firſt by the other Number. Example,

24 Ells of *Holland*, at 3*s.* 3*d.* per Ell
6 and 4

19, 6
4

3, 18, 0 Anſ.

or

3*s.* 3*d.*
12&2

1, 19, 0
2

3, 18, 0

This Example is wrought two Ways; that is, Multiply by 6 and 4 or by 12 and 2, both which give the ſame Anſwer, and each multiply'd together, produce the Quantity, *viz.* 24.

When the Quantity is ſuch a Number that no two Numbers multiply'd together will exactly make it, then multiply with two ſuch Numbers, as multiply'd together, come neareſt to the Quantiry; and multiply the Price by the Part that is wanting, and add the two Products together. Example,

26 Gallons of Brandy, at 8*s.* 4*d.* *per* Gallon.
4 and 6

l. 1, 13, 4
6

l. 10, 00, 0
s. 8|4 Multiply'd by 2 that is wanting. 2, 16, 8

l. 10, 16, 8 Anſwer.

The double Rule of Three.

THIS Rule is compos'd of 5 given Numbers, and teaches by them to find a ſixth in proportion.

Of theſe 5 Numbers, the firſt three always contain a Suppoſition, and the two laſt a Demand:

Ex. 1. If 100*l.* in 12 Months gains 5*l.* Intereſt, what will 84*l.* gain in 5 Months? The Suppoſition lies on 100*l.* 12 Months and 5*l.* and the Demand on 84*l.* and 5 Months; for 'tis ſaid, what will 84*l.* gain in 5 Months?

In the firſt Stating you muſt always obſerve, that the Number of the ſame Name with the Number ſought, muſt be the middle Number; and one of the other Numbers in the Suppoſition (it matters not which) muſt be the firſt Number, and that Number in the Demand of the ſame Name with the firſt, muſt be your third Number, and then your firſt Stating

l. P. *l. I.* *l. P.*
will ſtand thus, If 100 —— 05 —— 84. that is, If 100*l.* Principal gain 5*l.* Intereſt, what 84*l.* Principal, and

work'd

l.P. *l.I.* *l.P.*
work'd off thus: If 100—05—84
5
———
l. 4, 20 Anſw. *l.* *s.* *d.* 4, 4, 0
20
———
4, 00

I daſh off two Figures towards the right Hand, which is dividing by 100, according to the Rule in Diviſion; then I mul. multiply the Remainder 20 by 20, the next inferior Denomination, *&c.* And ſo much for the firſt Stating and Work ——— Again,

If 12 —— 4, 4 —— 5
Mo. *l.* *s.* Mo.
20
——
84
5
———
12|420
———
35 Anſwer.

Note, As it is in this ſecond Operation) that the Anſwer to your 1ſt Stating, muſt always be the ſecond Number in the ſecond Stating.

Thus by theſe two Operations (from whence it is call'd the *double Rule)* is the Anſwer found, *viz.* That if 100*l.* in 12 Months gain 5*l.* Intereſt, 84*l.* in 5 Months will gain 35*s.* as is manifeſt in the Work.

And thus are all Queſtions in this Rule wrought, as in the following Examples alſo:

Ex. 2. If 15*s.* pay 5 Men for 6 Days, how much will pay 20 Men for 10 Days? Anſwer, 5*l.*

Men *s.* Men
If 5 Men require 15, what 20?

Days *s.*
If 6 require 60
Days
what 10?

Anſwer, 100*s.* or 5*l.*

Ex. 3. If 6 Reapers reap 54 Acres in 6 Days, how many Reapers will reap 324 in 9 Days?

Acres Reapers Acres Days Reapers Days
If 54 require 6, what 324? If 6 require 36, what 9?
Anſwer, 24 Reapers.

Ex. 4. What Principal was it that gain'd 35*s.* in 5 Months, when 100*l* gain'd 5*l.* in 12 Months?

s. Int. *l. P.* *s. Int.* *Mo.* *l.P.* *Mo.* *l.*
If 100 require 100—35 If 12—35—5 Anſw. 84
12
5) 420(
84

This Queſtion is the Reverſe to the firſt Example in this Rule.

Fellowſhip: Or, Company.

THIS Rule teaches us by knowing the ſeveral Parts of which a Joint-Stock is compoſed, with a ſuppoſed Gain or Loſs reſulting therefrom; how to determine the ſeveral Shares of the Loſs or Gain, in proporſition to each Perſons Stock in Company.

Queſtions in this Rule are work'd by the Rule of Three, there being ſo many ſeveral Statings, as there are Members in the Joint-Stock.

The total Sum of the ſeveral Stocks is to be the firſt Number in the Rule of Three, the Gain or Loſs the ſecond, and each Man's particular Stock the third.

Ex. 1. Two Perſons enter Partnerſhip, A puts into Stock 450*l.* and B 640*l.* and in 12 Month's Trade they find their neat Profit to amount to 360*l.* the Queſtion is, what is each Perſon's Share of the ſaid 360*l.* in proportion to his Money in Company?

A 450
B 640

l. *l.* *l.* *l.* *l.*
If 1090—360—450— If 1090—360—640

(Here the Fractions make a Farthing)

Theſe Statings work'd according to the Nature of the Rule of Three give A for his Share ——— l. 148,12,5¼ [illegible]

And B for his Share ——— 211, 7,6¼ [illegible]

Which added together makes juſt —— 360, 00, 0 109 and is a ſure Proof of the Works being Right.

Ex. 2. Two Perſons enter into Company, C put in 50*l.* D put in 70*l.* and they gain'd 150*l.* I demand each Man's Share of the Gains?

C 50*l.*
D 70*l.*

	l.	*l.*	*l.*	*l.*	*l.*
If	120—gain	150, what 50	If 120 gain	150, what	70

Work according to the Tenour of the *Rule of Three*, & you will find that C muſt have *l.* 62, 10, 0
and D muſt have ——— 87, 10, 0

which makes ——— 150, 00, 0 the Gain.

Ex. 3. Three Men Company, E put in 90*l.* F 75*l.* and G put into Stock 84*l.* and they gain'd *l.* 130, 10*s.* what is each Man's Share of the Profit?

E 90
F 75
G 84

	l.	*s.*	*l.*		*l.*	*l.*	*s.*	*l.*
If	249——	130,	10——90	If	249——	130,	10——	75

	l.	*l.*	*s.*	*l.*
If	249—	130,	10—	84

Here the Fractions make a Half-penny, which is carried to the Farthings, *&c.*

		l.	*s.*	*d.*
Anſw.	E	47,	3,	4¼ [illegible]
	F	39,	6,	1½ [illegible]
	G	44,	0,	5¾ [illegible]
	Proof	*l.* 130,	10,	0

Ex. 4. Suppoſe 4 Butchers hire a Piece of Ground for a certain Time for 8*l.* into which H put 4 Oxen, I 6 Oxen, K 10 Oxen, and L 12 Oxen, what muſt each Butcher pay of the 8*l.* in proportion to the Beaſts put in?

			l.	*s.*	*d.*
H 4		H	1,	00,	0
I 6	**Anſw.**	I	1,	10,	0
K 10		K	2,	10,	0
L 12		L	3,	00,	0

l. Oxen O.*l.*O.

If 32 Oxen pay 8 what 4, *&c.* If 32.8,6 *proof l.* 8, 00, 0

Ex. 5. Admit three Perſons joyn in the Purchaſe of a Parcel of Muſlins amounting to *l.* 205, of whch M paid 50*l.* N 75*l.* and O 80*l.* and they proving to be damaged, there was loſt in the Sale 30*l.* What muſt each Perſon bear of the Loſs?

l.
M 50
N 75 } 205
O 80

l. *l.* *l.* *l.* *l.* *l.* *l.* *l.* *l.*
If 205 loſe 30, what 50? If 205, 30, 75, If 205,30,80

Here the Remainders added together, make the Diviſor, & make 1 Penny to be carried to the Pence, *&c.*

M 7, 6, 4—20
N 10, 19, —6 30 } Remainders.
O 11, 14, 1—155

Proof *l.* 30, 00 0,

When this Rule hath Relation to any particular Time, then you muſt multiply each Man's Stock by his Time, and add all the Products together; which Total muſt be the firſt Number, and then Work as before.

INTEREST.

Definition. VVHEN any Sum of Money is lent by one Perſon to another, the Money lent is call'd, *The Principal*; and the Money to be paid in Conſideration by the Borrower to the Lender, is call'd, *Intereſt*, or *Uſe Money*, for the continuance of the Principal in the Borrower's Hands or Cuſtody.

Intereſt is either Simple or Compound.

Simple Intereſt is that Money that grows, or ariſes from the Principal only, at ſuch a Rate *per Cent. per Annum*, according to Law; as the Rate at preſent is at 5 *per Cent. per Annum.*

Compound Intereſt is the Intereſt of the Principal, and (if it continues longer than the ſtated Time) Intereſt upon the Intereſt due from the ſaid Principal, and therefore call'd *Intereſt upon Intereſt.*

Queſtions in ſimple Intereſt may be anſwered by the ſingle or double *Rule of Three.*

By the ſingle *Rule of Three*, when the ſimple Intereſt of any Principal for any Time is known, then the ſimple Intereſt of any other Principal (at the ſame Rate of Intereſt) for the ſame Time may be found; a in the following Examples.

Ex. 1. If 100*l.* gain 6*l.* Intereſt in one Year, wha will 364 gain in the ſame Time? Anſ. 21*l.* 16*s.* 9*d.* State it as by the *Rule* of *Three*, & work it accordingly.

l. *l.* *l.*
If 100——6——364
6

21, 84
20

16, 80 Anſw. 21, 16, 9 $\frac{40}{100}$ or $\frac{4}{10}$ (*l.* *s.* *d* $\frac{1}{2}$)
12

9, 60
4

2, 40

According to the *Rule* of *Three*, I multiply the third Number by the ſecond, and divide by the firſt, which is moſt expeditiouſly done by ſeparating or cutting off 2 Figures towards the right Hand, by a Comma, or downright Stroke, and the Figures towards the left Hand are Pounds; then I multiply the Remainder 84 by 20, the next inferior Denomination, and then cut off 2 Figures towards the Right, and the two Figures towards the Left, to wit, 16 are 16*s.* then I multiply the Remainder 80 by 12, the next inferior Denomination, and do as before, and there quotes 9*d.* then I multiply by 4, *&c.* ſee the Work.

Ex. 2. What's the Intereſt of 400*l.* 12*s.* 9*d.* for 1 Year, at 5 *per Cent. per Annum*?

5 *per Cent.*

Anſ. *l.* 20,00,7 $\frac{1}{2}$ $\frac{60}{100}$ or $\frac{6}{10}$. *l* 20,03,3,9
20
s. , 03
12
d. 7, 65
4
qrs. 2, 60

Anſ. 20,00,7

You muſt always, as here, multiply the Principal by the Rate of Intereſt, according to the Method of multiplying Money in the *Rules* of *Practice* by Multiplication, carrying from one Denomination to the next, as in *Addition* of *Money*, &c. as here I ſay, 5 times 9 is 45*d.* or 3*s.* 9*d.* I ſet down 9 and carry 3*s.* and 5 times 12 is 60, and 3 is 63, or 3*l.* 3*s.* I ſet down 3, and carry 3*l.* then 5 times 0 is 0, but 3 is 3; and 5 times 0 is 0, and 5 times 4 is 20; then I cut off 2 Figures towards the Right, as before, then I multiply by 20, taking in the 3*s.* & cut off as before, but no Figures coming to the Left, there are no Shillings; then I multiply by 12, and take in the 9*d.* and do as before, and there comes out 7*d.* Laſtly, I multiply by 4, (but there are no Farthings to take in) and ſeparate 2 Figures to the Right, and to the left Hand there quotes 2 Farthings, as in the Work. Thus all Queſtions of this Kind in *ſimple Intereſt* may be wrought, let the Rate be what it will.

This Method is very expeditious, and very eaſy to be underſtood, and therefore needs no further Explication.

When the Rate hath a Fraction annexed to it, as 5½, 6¼, 8¾, and 2½ *per Cent.* then after you have multiply'd the Principal by the whole Number, that's by 5, 6, 8, or 2, then take ½, ¼, ¾, *&c.* of the Principal, and add it to the Product of the Principal multiply'd by the whole Number, (according to the Method preſcrib'd in *Multiplication*, of multiplying by a mixt Number) and then daſh off 2 Figures towards the right Hand, and proceed as before; as in this Example:

l. *s.* *d.* *l.*
Ex. 3. What's the Int. of 365, 10, 6½, at 5½ *p. Cent. p. An.*
5

l. *s.* *d.* 1827, 12, 8½
the ½ of 365, 10, 6½ is — 182, 15, 3¼

20, 10, 07, 11¾
20

2, 07
12

, 95
4

3, 83

l. *s.* *d.*
Anſ. 20, 2, 0, ¾ $\frac{83}{100}$

Here after I have added the fractional Part, I work in the ſame Manner as in the 2d Example preceeding as is ſeen in the Operation.

```
                                    l.    s.  d.      l.
Ex. 4. What's the Int. of 746, 12, 9   at 8¾ p. Cent.
                                            8
                               ----------  ----
                                5973, 02, 0
                          ½      373,  6, 4½
                          ½      186, 13, 2¼
                              -----------  ----
                               65, 33, 01, 64 ⎤
                                   20          ⎥
                                 --------      ⎥  Anſwer.
                                 6, 61         ⎥  l. s. d.
                                   12          ⎬  65,6,7¼
                                 --------      ⎥
                                 7, 38         ⎥
                                    4          ⎥
                                 --------      ⎥
                                 1, 55         ⎦
```

Thus much may ſuffice to find the Intereſt of any Sum of Money for a Year.

Calculation for Parts of a Year, or a longer Time.

First, Work for the Year, as before, then take Parts of the Intereſt of the whole Year, according to the Time mentioned.

Example 5.

What's the Intereſt of 46*l.* 10*s.* for 5 Months, at [5 *p. Cent. p. An.*

5

l. 2, 32, 10
20

s. 6, 50
12

d. 6, 00

Anſ. for a Year.

l. 2, 6, 6

4 Months is of a Year the $\frac{1}{3}$ 15, 6
1 Month is of 4 Months the $\frac{1}{4}$ 3, 10$\frac{1}{2}$

Anſwer 19, 4$\frac{1}{2}$ for 5M.

So the Intereſt of 46*l.* 10*s.* for 5 Months at 5 *per Cent. per Annum*, is 19*s.* 4*d* $\frac{1}{2}$: as in the Work.

l. *s.* *d.*
Ex.6. What's the Intereſt of 275,19,9 at 7 *p. Cent. per* [*An.* for 9 M.

7

l. 19, 31, 18, 3
20

s. 6, 38
12

d. 4, 59
9

qrs. 2, 36

l. *s.* *d.* for aY.
19,6,4$\frac{1}{2}$

6mo $\frac{1}{2}$ 9,13,2$\frac{1}{4}$
3m $\frac{1}{2}$ 6m 4 16,7

Anſ. *l.* 14,9,9$\frac{1}{4}$ for 9 M

What's the Intereſt of 896*l.* 9*s.* 8*d.* for 4 Yea and 8 Months, at 6*l.* $\frac{1}{4}$ *per Cent. per Annum*?

6

5378, 18, 0
$\frac{1}{4}$ 224, 2, 5

56, 03, 00, 5

20

,60
12

7, 25
4

1, 00

l. *s.* *d.*
56, 00, $7\frac{1}{4}$ for 1 Yea
4

224, 02, 5, for 4 Yea
$\frac{1}{3}$ 18, 13, $6\frac{1}{4}$ for 4 Mo
$\frac{1}{3}$ 18, 13, $6\frac{1}{4}$

l. 261, 09, $5\frac{1}{2}$

The Intereſt of 896*l.* 9*s.* 8*d.* for 4 Years and Months. So much for the Intereſt of an odd Su at an odd Rate, and for an odd Time, which (wi the *Examples* before) comprehends all Difficult that can ariſe in *ſimple Intereſt.*

Factorage, Brokeridge, Inſurance, &c.

BY the Method of the 2d, 3d, and 4th *Exampl* may all manner of Factorage, Brokeridge, Inſurance, or Averidge, (or any Thing elſe, if at much *per Cent.*) be calculated.

Example 1. What muſt a Factor have for his Commiſſion of Sales, when the Sum amounts to 249*l.* 18*s.* 6*d.* if his Allowance be 5 *per Cent.*

5

12, 49, 12, 6
20

9, 92
12

11, 10

l. *s.* *d.*
Anſwer 12, 9, 11

Ex. 2. To what amounts the Proviſion to of 865*l.* 11*s.* 4*d.* at 2$\frac{1}{2}$ *per Cent.*

2

1731, 2, 8
$\frac{1}{2}$ 432, 15, 8

21, 63, 18, 4
20

12, 78
12

9, 40
4

1, 60

l. *s.* *d.*
Anſwer 21, 12, 9$\frac{1}{4}$.

What's the Brokeridge of Goods ſold to the value of 98, 13*s*, 0*d*. at ½ *per Cent.* Anſwer 9*s*. 10*d* ¼.

```
  49, 6, 6
  20
 ---------
  9, 86  ⎫
     12  ⎪
 ---------                 s.  d.
 10, 38  ⎬ Anſw.  9, 10¼
      4  ⎪
 ---------
  1, 52  ⎭
```

Here the ½ of the principal Sum is taken, and then I work as before.

What's the Inſurance of 560, 10 at 10 Guinea's *per Cent.*

```
              l.    s.
             560,   10
                    10
            -----------
            5605,   00
10s.  ½      280,    5  ⎫
            -----------  ⎪
            58, 85, 5   ⎬ Anſ. 58l. 17
                 20      ⎪
            -----------  ⎪
            17, 05      ⎭
            -----------
```

When the Rate is at 5*s*. *per Cent.* take the 4th Part of the given Sum, and work as before,

When the Rate is at 10*s*. *per Cent.* take the half, and work, as in the 3d *Example.*

When the Rate is at 15*s*. *per Cent.* take half, and the half of that half, and add both together.

When the Rate is at 20*s*. *per Cent.* only daſh off two Figures, as before, and then multiply by 20 *per* 12, *&c.*

Compound Intereſt.

```
                                   l.    s.
WHat's the Int. of                264,  12   to continue for
for 3 Years, at                          5
5l.p.C.p.An. Int. upon Int.   ───────────┐
                              13, 23, 00 │ l.264,12
                                  20     │    13,4,7
                              ────────── │ ─────────── │1ſt.
l. 277, 16,                    4, 60     │ l.277,16,7  │Yr.
   13, 17, 9¾                     12     │          5
────────────                  ────────── │ ───────────
l.291,14, 4¼ 2d Yr.            7, 20     } 1389,02,11
          5                              │    ,20
────────────                             │ ───────────
14,58,11,11¾                             │   17,82
  20                                     │     12
──────                                   │ ───────────
11, 71     l. 291, 14, 4¾                │   9,95
   12          14, 11, 8½                │      4
────────   ─────                         │ ───────────
8, 63         ────────────               ┘  3 80
    4     l.306,06,1¼ laſt Year. Anſwer.
──────    ────────────
2, 55
──────
```

Here I firſt ſeek the Intereſt of the Money for the firſt Year, and find it *l.*13, 4, 7, which I add to the Principal *l.*264, 12, 0, which makes *l.*277, 16, 7, for Principal and Intereſt due the firſt Year; then I proceed in the ſame Manner to find the Intereſt of that, and find it to amount to *l.*13, 17, 9$\frac{1}{4}$ which I add to *l.*277,16,7, the Principal and Intereſt of the firſt Year, and it makes *l.*291, 14, 4$\frac{3}{4}$ for the ſecond Year; the Intereſt of which I find to be *l.*14,11,8$\frac{1}{2}$, which added to *l.*291, 14, 4$\frac{3}{4}$, the Principal and Intereſt of the ſecond Year, gives *l.* 306, 06, 1$\frac{1}{4}$, for the Principal and Intereſt of the 3d & laſt Year, & ſo much is due for the Loan of *l.*264, 12, 0, to continue for 3 Years at Intereſt upon Intereſt. This is the Vulgar Way, [and eaſieſt for Common Capacities] for calculating *Compound Intereſt*; *i. e.* to add the firſt Years Intereſt to the ſecond, and the ſecond Years Intereſt to the third, *&c.*

DISCOUNT.

Diſcount is when a Sum of Money hereafter due is ſatisfy'd, by paying down ſo much preſent Money; which if put to Intereſt at ſuch a Rate, would increaſe it ſelf to the Sum firſt due.

Ex. 1. What is the Diſcount of 324*l.* 15*s.* 6*d.* for 4 Months, at 6 *per Cent. per Annum*?

To do this, firſt ſee what Part of a Year the Time is, and take that Part of the Rate of Diſcount, and add it to 100*l.* and then by the *Rule of Three* ſay. If 100*l.* and the Money of the Rate added, Diſcount the Part of the Rate, what Diſcouut will 324*l.* 15*s.* 6*d.* [the Sum to be diſcounted] Diſcount?

The Time of Diſcount in this *Example* is Months, which is the $\frac{1}{3}$ of a Year, wherefore

tak

take ⅓ of 6*l.* the Rate of Diſcount, which is 2*l.* which added to 100*l.* makes 102*l.* then I ſay,

l. *l.* *l.* *s.* *d.*
If 102 diſcount 2 what will 324, 15, 6 Diſcount?
20 20
2040 6495
12 12
24480 77940
2
l. *s.* *d.*
2448,0)15589,0(6, 7, $4\frac{1}{4}\frac{816}{2448}$ Anſ.
14688
901
20
First due *l.* 324, 15, 6 18020(7*s.*
Diſcounted 6, 7, 4¼ 17136
884
Paid down *l.* 318, 8, 1¾ 12
10608 4*d.*
9792
816
4
3264 (4
2448
(816)

By the Work I find the Diſcount to be *l.* 6, 7, 4¼ which I deduct from the Money firſt due, and there remains *l.* 318, 8, 1¾ to be paid down in full Satisfaction

for

for 324*l.* 15, 6, the Sum firſt due. Thus by this Method of Working, may any Sum of Money be diſcounted, at any Rate, for any Time.

Ex. 2. What's the Diſcount of 275*l.* for 6 Months, at 5 *per Cent.*

l. *s.* *l.* *s.* *l.*
If 102, 10 abate 2, 10, what 275?
Anſwer 6*l.* 14*s.* 1*d* $\frac{3}{4}$ $\frac{}{20}$

In this *Example*, 6 Months is $\frac{1}{2}$ a Year, wherefore I take the $\frac{1}{2}$ of 5*l.* and add it to 100*l.* &c.

Ex. 3. Bought Goods to the value of 106*l.* 16*s.* 0, on 9 Months Diſcount, at 4 *per Cent. per Annum*, what muſt be paid down? Anſwer 103*l.* 13*s.* 9*d.*

4

6 Months $\frac{1}{2}$ } 2 If 103 diſcount 3, what 106, 16
3 Months $\frac{1}{6}$ } 1
Mo. ——
l. 3

Ex: 4. Sold Goods to the value of 376*l.* on 7 Mo. Diſount at 8 *per Cent. per Annum*, what muſt be paid down? Anſwer 359*l.* 5*s.* 11*d.*

8*l.*

6 Mo. $\frac{1}{2}$ } 4
1 Mo. $\frac{1}{6}$ } 0, 13, 4
of 6 M. } ——
l. 4, 13, 4 If 104, 13, 4 Diſc. 4, 13, 4, wt. 376

		l.	*s.*	*d.*
First due	*l.*	376,	00,	0
The Diſcount		16,	14,	1
To be pd. down	*l.*	359,	5,	11

BARTER.

BARTER is no more than the Exchanging of one Commodity for another; but ſo to proportion their Rates, as that neither Party ſuſtains Loſs.

So that by knowing the Worth of the Commodity barter'd for in ready Money, and what I muſt have it for in *Barter*, I may ſet a Price on my own Goods anſwerable thereto.

Ex. 1. Two Men Barter, *viz.* A and B, A hath 3 C $\frac{1}{2}$ of Pepper, at 13*d* $\frac{1}{2}$ *per* ℔, and B hath Ginger at 15*d* $\frac{1}{4}$ *per* ℔, I demand how much Ginger muſt be given to A for his Pepper?

Firſt ſee by *Practice* what the Pepper comes to at 13*d* $\frac{1}{2}$ *per* ℔, & you'll find it amount to *l.* 22, 01, 0, then ſay by the *Rule of Three*, If 15*d* $\frac{1}{4}$ buy 1 ℔ of Ginger, what will 22*l.* 1*s.* buy? Work according to the *Rule of Three*, and you will find, that 347 ℔ of Ginger muſt be given by B to A for his Pepper, and 1 Farthing remains: And as a Proof of which, if you caſt up the 347 ℔ of Ginger at 15*d* $\frac{1}{4}$ *per* ℔, and take in the odd Farthing remaining, you will find it amount to juſt 22*l.* 1*s.* the Price of the Pepper; ſo that there is Value for Value in Money, though the Commodities and Prices are different.

Ex. 2. Suppoſe C hath Nutmegs worth 7*s.* 6*d.* *per* ℔ ready Money, but in Barter he will have 8*s.* *per* ℔; and D hath Leaf Tobacco worth 5*d. p.* ℔ ready Money, the Queſtion is, how D muſt rate his Tocacco *per* ℔ in Barter, that his Profit may be equivalent with C's? State the Queſtion thus;

If 90*d* riſe to 96*d*, what muſt 9*d* riſe to? Anſwer, to 9*d* ½, as may be found by the Operation. And the Conception is Natural and Eaſy, for 90*d* is raiſ'd to half a Shilling, and 9*d* riſes to Half a Penny.

Ex. 3. If E hath 114 ℔ weight of Tobacco, at 6*d per* ℔, how much Cotton at 14*d per* ℔ muſt F give E for the Tobacco? Anſwer, *l.* 48 $\frac{6}{7}$ — The Tobacco at 6*d per* ℔ comes to 57*s.* then ſay, If 14*d* buy 1 ℔ of Cotton, what will 57*s.* buy? By the Work it will be found *l.* 48 $\frac{6}{7}$, as above.

Ex. 4. If G hath 80 Cloths at 3*l. per* Piece ready Money, but in Barter he will have 4*l. per* Cloth. H has Wool's at 7*l.* 10*s. per* C. which are worth but 6*l. per* C in ready Money; I demand what Quantity of Wool pays for the Cloths, and which of the Two is the Gainer; and how much?

	s.	C	*s.*		C qrs. *l.*
If	150 —	01 —	6400	Anſ.	42, 2, 18
	s.	*s.*	*s.*		*s.*
If	60 —	20 —	120	Anſ.	40.

Whereas he riſes but 10*s* in Barter; ſo that C gains 16*l.* by the Barter.

Ex. 5. Indigo at 4*s* 6*d per* ℔ ready Money, but in Barter at 5*s* 4*d.* How muſt Galls at 16*d per* ℔ ready Money be rated in Barter to make an equivalent Profit.

	d	*d*	*d*		*d*
If	54 —	64 —	16	Anſwer	18¾ $\frac{46}{54}$

Ex. 6. Admit I hath Holland at 5*s per* Ell ready Money, barter'd at 6*s per* Ell to K for Broad Cloth, at 9*s* 6*d per* Yard, which coſt but 8*s per* Yard; which gaineth moſt, and how much *per Cent*?

s *s*—— *l* *l*
If 5——6——100 Anſwer 120 *per Cent.*
s *d* *l*
If 8——114——100 Anſwer 118, 15 *per C.*

EXCHANGE.

EXCHANGE is the receiving of Money in one Country or Nation, and paying it again in another, Value for Value, with reſpect to the ſeveral Species of Coin or Money of each Country or Nation.

Flemiſh Money —— 2 *Groots* 1 *Stiver* —— 6 *Stivers* 1 *Shilling* —— 20 *Stivers* 1 *Guilder* —— 6 *Guilders* 1 *l. Flemiſh.*

Queſtions in this Rule are for the moſt Part anſwer'd by the *Rule of Three*, and are ſuch as theſe that follow:

Ex. 1. Remitted from *London* to *Rotterdam*, a Bill of Exchange of 260*l. Sterling*, the Exchange at 33*s.* 4*d. Flemiſh per l. Sterling*; what *Flemiſh* Money muſt the *Bill* be drawn for?

s. Sterling. *s. 4d. Flemiſh.* *l. Sterl.*
If 20 ——— 33, 4 ——— 260
12 20

400 5200
400

2, 0) 208000, 0

2 Groots 1 Stiver 2) 104000

20 Stivers 1 Guilder 5200, 0

Anſwer 2600 Guilders.

Ex. 2. Remitted from *Amſterdam* to *London*, 487*l.* 12, 6 *Flemiſh*, the Exchange at 36*s. Flemiſh* for 20*s.* *Sterling*; the Queſtion is, What *Sterling* Money muſt be received for the ſaid Bill of 487*l.* 12, 6 *Flemiſh*.

s. Flem. *s. Sterl.* *l. Flem.* *l. Sterl.*
If 36 give 20 what 487, 12, 6 Anſ. 270, 18, 1

French Money.	*Ex.* 3. How many *French*
12 Deniers 1 Sol,	Crowns muſt be drawn by Bill
20 Sols 1 Livre,	of Exchange for 210*l.* 17, 10
3 Livres 1 Crown.	*Sterl.* the Exchange. at 57*d*

d s *Sols Fr.* *l.* *s.* *d. Sterl* *Crown. Liv s.*
If $57\frac{1}{8}$ —— 60 —— 210, 17, 10 Anſ. 886, 00, 1

Ex. 4. For what *Sterling* Money muſt a Bill be drawn in *Paris*, and payable in *London*, to Anſwer 1510 Crown 2 Liv. 10 Sols, the Exchan. at 55*d*

S. *D.* *Cr. Liv. S.* *l.* *s.* *d.*
If 60 —— $55\frac{1}{8}$ —— 1510, 2, 10 Anſ. 347, 00, $4\frac{5}{7}$

Ex. 5. How many Rix-dollars at 60*d.* may be drawn for a 1000 *Naples* Ducats, at 52*d.*

If 52——1000——60 Anſwer $866\frac{2}{3}$

This Example is wrought by an inverted Proportion; for there muſt be fewer Pieces of 60*d.* given, than of 52*d.* wherefore the greater Extream is the Diviſor, which is the 3d Number.

In Queſtions where a Compariſon is made of Weights or Meaſures of different Places, ſuch Queſtions may be anſwered by one ſingle *Rule of Three*, as in theſe Examples.

Ex. 6. If 100 Ells of *Antwerp* make 75 Yards at *London*, how many Yards of *London* Meaſure will 27 Ells of *Antwerp* make? Say,

Ells *Antw.* Yds *Lond.* E. *Antwerp.* Yds.
If 100——75——27 Anſwer $20\frac{1}{4}$

Ex. 7. Again, If 100*l.* *Avoirdupois* in *London* be equal to 89*l.* in *Paris*, how many *l.* of *Paris* Weight are equal to 340*l.* *Avoirdupois* in *London*? Say,

l. Lond. *l. Par.* *l. Lond.*
If 100 be 89 what 340 Anſwer $302\frac{3}{5}$

PROFIT and LOSS.

MAY be comprehended under theſe four Heads: *viz.*

1*ſt*, To know what is gain'd or loſt *per Cent.*

2*dly*, To know what a Commodity ought to be ſold for to gain or loſe ſo much *per Cent.*

3dly, Having gain'd or loſt ſo much *per Cent.* to know what the Commodity coſt.

4thly, If a Commodity ſold at a given Rate, do gain or loſe a given Rate *per Cent.* how much will be gain'd or loſt *per Cent.* if it be ſold at another Rate.

To known what is gain'd or loſt per Cent.

Ex. 1. If 1 Yard of Cloth is bought for 11*s.* and is ſold for 12*s.* 6*d.* how much is gain'd *per Cent*?

	s.	*d.*
	12,	6
Subſt.	11,	6
	1,	6 gain'd on every Ell.

Then ſay, If 11*s.* gain 18*d.* what 100*l.* Anſwer, 13*l.* 12*s.* 8*d* $\frac{8}{11}$ *per Cent.*

Ex. 2. If 1 ℔ of Tobacco coſts 16*d.* and is ſold for 20*d.* what is gain'd *per Cent*? Say,

If 16*d.* gain 4*d.* what 100*l.* Anſwer 25*l. per Cent.*

Here the Proportion is very obvious, for as 4 is the 4th of 16, ſo is 25 of 100.

The like Method is uſed to diſcover Loſs.

To know what Goods *ought to be ſold for to gain or loſe ſo much* per Cent.

Ex. 3. If 100 ℔ of Hops coſt 4*l.* what muſt 1 ℔ be ſold for to gain 10 *per Cent*?

Rule ——— Make 100*l.* the firſt Number in the *Rule of Three*, the Price the ſecond, and 100*l.* with the Gain added, or the Loſs ſubſtracted, the third; Thus,

If

l. *l.* *l.* *l.* *s.*
If 100———4———110 Anſwer 4, 8
l. *l.* *s.* *l.* *d.*
Again, If 100—4, 8—what 1 Anſ. $10\frac{1}{2}\frac{6}{100}$ *p.* ℔

By the firſt Working I find what the Whole muſt be ſold for to gain 10 *per Cent.* and by the ſecond, what a ℔ muſt be ſold for to the ſame End.

Ex. 4: If 60 Ells of Holland coſt 18*l.* what muſt 1 Ell be ſold for to gain 8 *per Cent* ?

l. *l.* *l* *l.*
If 100——18——108 Anſwer 19, 8, $9\frac{1}{2}\frac{4}{10}$
Ells *l.* Ell *s.*
If 60——19, 8, $9\frac{1}{2}$ what 1 Anſ. 6, $5\frac{1}{2}$ *p.* Ell.
And ſo for Loſs.

Having gain'd or loſt ſo much per Cent: *to know what the Goods coſt.*

Ex. 5. If a Parcel of Cloth be ſold for 560*l.* and 12*l. per Cent.* gain'd, what did the Cloth coſt ?

Rule———Add the Gain to 100*l.* (or ſubtract the Loſs) and let it be the firſt Number in the *Rule of Three,* 100*l.* the ſecond, and the Principal given the third, *&c.*

If 112*l.* come to 100*l.* what 560*l.* Anſwer 500*l.*

Ex. 6. If 40*l.* of Cocheneal is ſold for 51*l.* at 9*l. per Cent.* Profit, what is the Price of 1 ℔ at that Rate ?

If 109*l.* decreaſe to 100*l.* what 56*l.* Anſ. 51*l.* 7, $6\frac{30}{109}$
Again, If 40 coſt 51*l.* 7, $6\frac{1}{4}$ what 1*l.* Anſ. 25*s.* 8*d* $\frac{1}{4}$

If Goods ſold at ſuch a Rate, do gain or loſe a given Rate per Cent. *how much* per Cent. *will be gain'd or loſt, if the Goods be ſold at another Rate?*

Ex. 7. If 1 lb of Tobacco be ſold for 20*d.* and there be 25 *per Cent.* Profit, what will be gain'd or loſt if the lb be ſold for 16*d*?

Rule——Let the firſt Price be the firſt Number in the *Rule of Three*, 100*l.* with the Gain added, or the Loſs ſubſtracted, the ſecond, and the other Price the third——So that you muſt ſay,

d. *l.* *d.* *l.*
If 20——125——16 Anſwer 25 *per Cent.* Loſt.

Ex. 8. If 1 Gallon of Wine be ſold for 8*s.* at 8 *per Cent.* loſs, what will be gain'd *per Cent.* if the Gallon be ſold at 12*s*? Say,

s. *l.* *s.* *l.*
If 8——92 Loſs——12 Anſ. 38 *per Cent.* Profit.

EQUATION.

EQUATION *of Payments* teaches us to reduce ſeveral Times of Payment, upon which particu- Sums of Money are due, unto a mean Time, upon which the total of thoſe Sums ought to be paid without Damage to the Debtor or Creditor.

Ex: 1. Admit a Merchant owes 500*l.* to be paid at three Payments, *viz.* 300*l.* at 4 Months, 100*l.* at 6

Months, and 100*l.* at 12 Months; but it is mutually agreed, That the Whole be diſcharged at one Payment; The Queſtion is, At what Time that Payment ought to be made without Damage to Debtor or Creditor, accounting 5 *per Cent. per Annum* Intereſt?

Rule——Multiply each particular Payment by its Time, then add all the Products together, and divide the Total by the whole Debt.

l.	*l.*	*l.*
300	100	100
at 4 Mon.	6 Mon.	12 Mon.
1200	600	1200

1200
1200
600

5,00) 30, 00

Anſwer 6 Months is the equated Time for the Payment of the Whole.

Ex. 2. Suppoſe a Merchant oweth 300*l.* to be paid ⅓ at 3 Months, ⅓ at 6 Months, and ⅓ at 12 Months, I demand at what Time the ſaid Sum ought to be paid together?

l.	*l.*	*l.*
100	100	100
at 3 Months	6 Months	12
300	600	1200

1200
600
300

3, 00) 21, 00

Anſwer 7 Months.

Ex. 3. A Merchant oweth 450*l.* to be paid at three Payments, *viz.* $\frac{1}{3}$ at 3 Months, $\frac{1}{3}$ at 5 Months, and $\frac{1}{3}$ at 8 Months, and the Debtor and Creditor agree, That the whole Sum ſhall be paid at one Time; I demand what Time it ought to be paid in?

l.	*l.*	*l.*	
150	150	150	1200
3 Mon.	5 Mon.	8 Mon.	750
			450
450	750	1200	

45, 0) 240,0 (5 Mo. $\frac{1}{3}$ Anſ.

Ex. 4. Suppoſe a Woman's Portion of 340*l.* is to be paid at three Payments, *viz.* 80*l.* down, 100*l.* at 3 Months, and 160*l.* at 8 Months; What's the equated Time for Payment?

l.	*l.*
100	160
3 Months	8 Months
300	1280
	300

34, 0) 158,0 (4 Months $\frac{11}{17}$ Anſwer.

136

(22)

Suppoſe there is 245*l.* 10*s.* 9*d.* to be paid $\frac{1}{2}$ at 6 Months, $\frac{1}{3}$ at 8 Months, and the reſt at 12 Months; what is the indifferent Time for Payment of the whole Sum together?

	Mo.		Mo.
$\frac{1}{2}$ at	6	Anſ.	3
$\frac{1}{3}$ at	8	Anſ.	2 $\frac{2}{3}$
$\frac{1}{6}$ at	12	Anſ.	2

7 $\frac{2}{3}$ Anſwer 7 Months $\frac{2}{3}$

Here becauſe $\frac{1}{2}$ is to be paid at 6 Months, I take $\frac{1}{2}$ of 6, which is 3 Mon. and $\frac{1}{3}$ to be paid at 8 Mon. I take $\frac{1}{3}$ of 8, which makes 2 Months $\frac{2}{3}$; and 6 being the $\frac{1}{2}$ of 12, I ſet down 2 Months, which added together make 7 Months $\frac{2}{3}$ for the indifferent Time of Payment See the Work.

ALLIGATION.

TEaches to reſolve Queſtions concerning the mixing of diverſe Simples together; and conſiſts of two Parts, *viz.*

ALLEGATION MEDIAL, and *ALLEGATION ALTERNATE.*

Allegation Medial is, when having the ſeveral Quantities and Rates of ſeveral Simples propounded, we diſcover the mean Rate of the Mixture compounded of thoſe Simples. .

Ex. 1. Suppoſe a Mealman hath Flour of ſeveral Prices, and would mix them ſo, that the Quantity mixed might bear one common Price, and mixes together the Quantity following: *viz.*

$$\left.\begin{matrix}3\\4\\5\end{matrix}\right\}\text{Buſhels at}\left\{\begin{matrix}3, & 5\\5, & 6\\4, & 8\end{matrix}\right\}\textit{per}\text{ Buſhel}\left.\vphantom{\begin{matrix}3\\4\\5\end{matrix}}\right\}\text{The Queſtion is,}$$

What a Buſhel of this Mixture is worth?

To do this, I add the Number of Buſhels together, which are 12; then what they come to at the different Prices, and it makes 55*s.* 7*d.* then I ſay by the Rule of Three, If 12 Buſhels coſt 55*s.* 7*d.* what 1 Buſhel? and the Anſwer is, 55*d* $\frac{1}{2}\frac{1}{3}$. or 4*s.* 7*d* $\frac{1}{2}$ *per* Buſhel.

*Ex.*2. Admit a Vintnter mixes (or parts they call it)
20 Gallons of *Port*, at 5*s.* 4*d. per* Gallon, with
12 Gallons of *Galecia*, at 5*s.* 0 *per* Gallon, with
30 Gallons of *Liſbon*, at 6, 0 *per* Gallon, with
20 Gallons of *Vienna*, at 4*s.* 6*d. per* Gallon ——
——
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What is a Gall of this Mixture worth? Anſ. 5*s.* 3*d* $\frac{3}{4}$

After I have caſt up the ſeveral Articles by *Practice*, I find them amount to 436*s.* 8*d* then I ſay,

If 82 Gall. coſt 436*s.* 8*d.* what 1 Gall. Anſ. 5*s.* 3*d.*

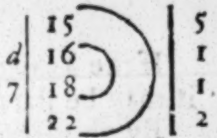
To prove this *Example*, or any other in this *Rule*, find the Value of the whole Mixture, according to the mean Price found, and if it agree with the total Value of the ſeveral Quantities, at the ſeveral Prices, the Work is Right. As here, 82 Gallons, at 5*s.* 3*d* $\frac{3}{4}$. *&c. per* Gallon, will amount to 436*s.* 8*d.* the total Value of 82 Gallons, at different Prices.

Allegation Alternate.

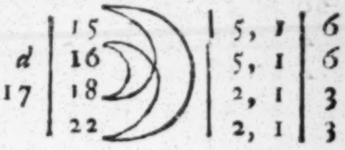
Is when having the Rates of divers Simples, we diſcover ſuch Quantities of them, as are neceſſary to make a Mixture, which may bear a certain Rate propounded.

Ex. 3. As, Suppoſe a Tobacconiſt determines to mix 20*l.* of Tobacco, at 15*d. per* lb with other Sorts of ſeveral Prices, *viz.* ſome of 16*d.* ſome of 18*d.* and ſome of 22*d. per* lb. the Queſtion is, How many lb of each Sort, he muſt take to make 1 lb of that Mixture worth 17*d.*

Firſt,



Firſt, Set down the mean Rate, or Price propounded on the Left-hand, & the given Rates on the Right, orderly under one another. *Secondly*, Link the Numbers placed on the Right-hand together with a crooked, or arch'd Line, in ſuch ſort, that one that is greater, may be link'd with one that is leſſer than the mean Rate, ſo will the Numbers be plac'd and link'd, as in the *Example*. *Thirdly*, having link'd the Numbers, find the Difference between the Numbers and the mean Rate, and ſet down the difference of each Number, juſt againſt the Number that is coupled with it: When one Number is link'd to divers other Numbers, the Differences ought to be as often tranſcribed, as it is diverſly link'd, ſo in the *Example* you may link the Numbers, as in the Work.



When in one and the ſame Line there are found more Differences than one, add them together, and write the Sum juſt againſt the ſame Differences, having firſt drawn a Line; then the Queſtion may be anſwer'd by 3 Statings, and Working by the *Rule of Three*, thus: If 5 (the Difference annexed to the firſt Number) give 1, (the Difference annexed to the ſecond Number) what will 20 give? (the given Quantity of the firſt ſort of Tobacco) at 15*d*. *l.*

Again for the Quantity of the 3d Sort, ſay, } If 5 give 1, what 20 (4 A.
If 5 give 1, what 20 (4 A.
Laſtly, ſay ———— If 5 give 2, what 20 (8 A.

So that from theſe Operations I conclude, That if with the 20*l.* at 15*d. per* lb. you mix 4 lb of Tobacco at 16*d.* and 4 lb at 18*d. per* lb. and 8 lb at 22*d.* lb. 1 lb of that Mixture of Tobacco, may be ſold for 17*d.*

If the *Example* be work'd after the ſecond Order, then it may be ſtated thus :

By this ſecond Method of Working, I conclude, That if with 20*l.* of Tobacco at 15*d*		*l.*
	If 6 give 6, what 20	(20 Anſ.
	If 6 give 3, what 20	(10 Anſ.
	If 6 give 3, what 20	(10 Anſ.

per ℔, there be mixed 20 ℔ at 16*d.* and 10 ℔ at 18*d.* and 10 ℔ at 22*d. per* ℔. 1 ℔ of Tobacco of this Mixture may be ſold for 17*d.* as before.

The Truth of this *Rule* may be prov'd by comparing the total Value of the ſeveral Simples, with the Value of the whole Mixture, So in the laſt *Example* propounded.

℔		*d*	℔		*d.*
20	at	15	*per*	is	300
4	at	16	*per*	is	64
4	at	18	*per*	is	72
8	at	22	*per*	is	176

36 ℔ at 17*d.* (the Price propounded) is alſo 612 *d.*

The RULE *of* FALSE.

THE *Rule of Falſe* is always performed by falſe or ſuppoſitial Numbers (from whence it hath its Name) taken at Pleaſure, by which we diſcover the true Terms required.

The Rule of Falſe is either *ſingle* or *double*.

The *ſingle Rule* is when by one feigned, or ſuppoſed Number, we find the true Number ſought.

Ex. 1. Suppoſe the 3d Part of an Army were killd; the 4th Part were taken; and 1000 fled; the Queſtion is, What Number of Men of the Army were kil'd? And how many were taken Priſoners?

Suppoſe the Army conſiſted of 600 Men, then there were 200 Men killd', and 150 taken Priſoners, and 250 fled; but 'tis ſaid thare were 1000 fled; wherefore ſay, If 250———600———1000 Anſwer 2400

$\frac{1}{3}$	is	800
$\frac{1}{4}$	is	600
		1000
		2400

So that by the falſe Suppoſition 600, I find the true Number of Men that the Army did conſiſt of, *viz.* 2400; the Third of which is 800 for the Men kill'd; and 4th is 600 for thoſe taken Priſoners, which with the 1000 that fled make 2400; As in the Work.

Ex. 2. Admit a Man dies, and leaves 120*l.* to be given to 3 Perſons, *viz.* A, B, C as follows, A to have a Share unknown, B to have twice as much as A, and C three times as much; what is the Share of each?

Suppoſe A had 15*l*: then B muſt have 30*l.* and C 45*l.* which added together make but 90*l.* which ſhould be 120*l.* wherefore I find their reſpective Shares by this Proportion, *viz.*

l. *l.* *l.* *l.*
If 90—120—15 Anſwer 20 A's Share.
So that finding A's Share to be 20*l.* then B's muſt be ——————— 40 B's Share.
and C's Share muſt be ——— 60 C's Share.

which added together make——120 the Total of the Money left.———

Ex. 3. A Man overtaking a Maid driving a Flock of Geeſe, ſaid to her, *How do you do Sweet-heart? whither are you going with thoſe* 30 *Geeſe? No Sir*, ſaid ſhe, *I have not* 30, *but if I had as many more, and half as many more, and* 5 *Geeſe beſides, I ſhould have* 30. The Queſtion is, How many Geeſe ſhe had?

Suppoſe ſhe had 12, then as many more make 24, and half as many more make 30, and 5 Geeſe beſides make 35; then I ſay, If 35 come of my Suppoſition 12, what will 30 require? Anſwer 10.

12

35) 360 (10 Anſwer.
35

(10)

Ex. 4. A Perſon deliver'd to another a Sum of Money unknown, to receive Intereſt for the ſame [illegible] 6 per Cent per *Annum*, ſimple Intereſt, and [illegible] of 10 Years receiv'd for Principal and [illegible] What was the Sum lent?

Suppoſe the Sum was 100*l.* to which adding 10 Years Intereſt, at 6 *per Cent.* makes 160*l.* Then ſay,

l. *l.* *l.* *l.*
If 160——100——300 Anſwer 187, 10, 0.
And ſo much was the Money firſt lent.

The double Rule of Falſe.

IS, when we make uſe of two ſuppoſitial, or feigned Numbers, to reſolve the Queſtion by.

When a Queſtion is propoſed belonging to this *Rule*, you may ſuppoſe one Number at pleaſure, with which proceed, as with the true Number; if it anſwers the Queſtion, your Work is done; if not, note whether the Error be too much or too little, which place under the Suppoſition by it which it was produced. Then again, make the ſecond Suppoſition, with which proceed as with the firſt, and place the Error proceeding, whether too great, or too little, under its Suppoſition; then multiply the firſt Suppoſition by the ſecond Error, and the ſecond Suppoſition by the firſt Error; and if the Errors be both of one Kind, that is, both too much, or both too little, then the Difference of the Products found by *Subtraction* is your Dividend, and the Difference of the Errors is the Diviſor, and the Quotient will be the Number required. But if the Errors be of different Kinds, that is, one too great, and the other too little, then take the Sum of the two Products for the Dividend, and divide it by the total Sum of the Errors, and the Quotient will be the Anſwer. According to this Verſe,

Addito diſſimiles, ſubtrahitoque pares——

Or thus, *When Errors are of unlike Kinds*,
Addition *does enſue*;
But when alike, Subtraction *finds*
dividing Work for you.

Ex. 1. A Man hath two ſilver Cups of unequal Weight, having to them both one Cover, weighing 5 Ounces; now if the Cover be put upon the leſſer Cup, it will be in double Proportion to the weight of the greater Cup; and the Cover being ſet on the greater Cup, it will be in tripple Proportion to the weight of the leſſer. The Queſtion is, What is the Weight of each Cup?

To reſolve this, Suppoſe that the weight of the leſſer Cup is 7 Ounces, then this with the Cover will weigh 12 Ounces; and becauſe this ſhould be double the weight of the greater Cup, the greater muſt weigh 6 Ounces; this added to the weight of the Cover, *viz.* 5, make 11 Ounces, which ſhould be three Times the weight of the leſſer Cup; Now 3 times 7 is 21, from which taking 11, I find 10 to be the firſt Error, too little, which I place under my Suppoſition 7, making a Croſs between them, as in the *Margin.*

$$\begin{array}{rcr} 7 & \times & 9 \\ 10 & & 15 \\ \hline 90 & & 105 \\ & & 90 \\ \hline & & 5)\,15 \\ \hline & & \text{Oz. } 3 \\ \hline \end{array}$$

Suppoſe again, That the leſſer Cup weigh 9 Ounces, and proceeding with this Suppoſition, as with the firſt, I find the ſecond Error to be 15, too little, which being plac'd under the ſecond Suppoſition, as in the *Margin*; according to the Direction in the *Rule*, I multiply 7, the firſt Suppoſition, by 15, the ſecond Error, and the Product is 105. Again, I multiply 9, the ſecond Suppoſition by 10, the firſt Error, and the Product is 90. And *laſtly*, Becauſe the Errors are of like Kind, *viz.* both too little, I ſubtract 90 from 105, And the Remainder is 15, which I divide by 5, the Difference of the Errors, and the Quotient is 3, the weight of the leſſer Cup. And to find the weight of the Greater, I add 5, the weight of the Cover, to 3 the weight of the leſſer Cup, and the Sum is 8. And becauſe by the Queſtion, the weight of the leſſer

Cup with the Cover, muſt be double the weight of the Greater, therefore half the weight of the leſſer Cup and Cover, muſt be the weight of the Greater, which is 4 Ounces.

This I think ſufficient for a verbal Demonſtration of this *Rule*, and therefore ſhall only add one other *Example*.

Ex. 2. There was a Bricklayer oblig'd to build a Wall in 40 Days, and it was agreed, That every Day that he work'd he ſhould have 2*s.* 1*d.* and every Day he play'd he ſhould forfeit $\frac{1}{2}$ Crown ; ſo that when the Wall was finiſh'd, and the Reckoning made, the Bricklayer receiv'd but 5*s.* 5*d.* The Queſtion is, What number of Days he work'd, and how many he play'd? ——— Anſwer, He work'd 23, and play'd 17 Days.

FRACTIONS, *Vulgar and Decimal.*

HAVING in the preceeding Part of this Book, ſufficiently treated of *Arithmetick in whole Numbers*, I come now to ſpeak of the *PARTS*, or Fragments of Unity, call'd, *FRACTIONS*; and this I ſhall do with plainneſs and brevity.

Definition 1. *Fractions* are either *vulgar* or *decimal*.

2. A vulgar Fraction conſiſteth of two Parts, *viz.* a Numerator, and a Denominator. The Numerator ſtands above, and the Denominator below a ſmall Line, thus, $\left\{\frac{5}{6}\right.$ $\begin{matrix}\text{Numerator}\\ \text{Denominator}\end{matrix}\Big\}$ and to be read ſive Sixths;

and if Parts of a Pound, or 20 Shillings, it would expreſs, or ſignify, That if 20 Shillings were divided into 6 Parts, this Fraction would ſtand for 5 of thoſe 6 Parts; that is, 5 three and four Pences, or 16*s.* 8*d.* The Numerator expreſſes the number of Parts, and the Denominator giveth to thoſe Parts their Names.

3. Vulgar Fractions are either Simple or Compound; a Simple vulgar Fraction hath only one Numerator and one Denominator, as, $\frac{3}{4}$, three Fourths, or three Quarters, and is either proper, or improper; proper when the Numerator is leſs than the Denominator, as $\frac{3}{8}$, three Eighths; improper, when the Numerator is greater than the Denominator, as, $\frac{8}{4}$, eight Fourths, which is two Integers; for eight Fourths of a Pound is 40*s.* or 2*l.* And if the Numerator and Denominator are equal, then the Fraction is equal to a whole Thing, as, $\frac{4}{4}$, four Fourths, of a Penny is a Penny; and $\frac{5}{5}$ of an Ell is an Ell And the Reaſon is plain, for the Integer contains juſt ſo many Parts as the Denominator expreſſes.

A Compound Fraction (or a Fraction of a Fraction) is, when an Integer is divided into Parts, and thoſe Parts ſubdivided into other Parts, and are expreſt with two or more Fractions, with this *Particle* (of) betwixt them, as 3 Farthings may be thus expreſt, $\frac{3}{4}$ of $\frac{1}{12}$ of $\frac{1}{20}$ of a Pound; and 5 Pence $\frac{5}{12}$ of $\frac{1}{20}$ of a Pound, *&c.*

5. When a whole Number hath a Fraction joined to it, then its call'd a *Mixt Number*, as *l.*4$\frac{5}{8}$ is 4 Pounds $\frac{5}{8}$, or 4*l.* 12*s.* 6*d.*

Reduction.

REDUCTION.

REDUCTION of Vulgar Fractions is Twofold, *viz.* into a common, or into the leaſt Denomination.

I. *To reduce Fractions of unequal Denominators into Fractions of equal Value, that ſhall have one common Denominator.*

Rule

Multiply each Numerator into all the Denominators except its own, and take the reſpective Products for new Numerators; then multiply all the Denominators continually, and the laſt Product thence ariſing ſhall be a new Denominator, common to all the Numerators found before.

Example, Reduce $\frac{2}{3}$ $\frac{3}{4}$ $\frac{5}{6}$ & $\frac{7}{8}$ of a Pound to a common Denominator.

Firſt I ſay, 4 times 2 is 8, and 6 times 8 is 48, and 8 times 48 is 384, for the firſt Fraction $\frac{2}{3}$, and ſo of the reſt; then I multiply the Denominators continually, ſaying, 3 times 4 is 12, and 6 times 12 is 72, and 8 times 72 is 576, for the common Denominator, and being thus reduced, ſtand thus,

$\frac{384}{576}\ \frac{432}{576}\ \frac{480}{576}\ \frac{504}{576}$ or thus $\frac{384\quad 432\quad 480\quad 504}{576}$

Note, That if you take away the common Denominator, then the Numerators are whole Numbers, and have the ſame Proportion that the given Fractions have.

The Reaſon of thus reducing Fractions, is to fit them for *Addition* and *Subſtraction*, &c. which otherwiſe cannot be done; but in Decimals there is no Occaſion for this *Reduction*, as I ſhall ſhew hereafter.

II. *To abreviate or reduce a Fraction into its loweſt Terms.*

Rule

Divide both Numerator and Denominator by ſuch a Number as divides both without any Remainder in either of them.

When the Numerator and Denominator are even Numbers, then they may be abreviated by halving them continually, or dividing them by 2, as $\frac{12}{28}$ may be reduc'd to $\frac{3}{7}$, thus

$\frac{12}{28} \Big| \frac{6}{14} \Big| \frac{3}{7}$

Here I ſay, the half of 12 is 6, and the half of 28 is 14, then the half of 6 is 3, and half of 14 is 7, as in the Example. Or you may reduce it ſooner, by dividing by any other Number that divides the Fraction without any Remainder, as 4 brings $\frac{12}{28}$ into $\frac{3}{7}$ at once; the 4's in 12 3 times, and the 4's in 28 7 times.

When you can no longer halve them, you may divide them by 3 4, 5, 6, 7, 8, or 9, if they ſo divide as to leave no Remainder; and after you have divided by a great, you may yet divide by a leſſer Number, to reduce the Fraction ſtill lower.

Example, Reduce $\frac{84}{168}$ into its loweſt Terms.

$$2\Big\{\frac{84}{168}\ \Big|\ \frac{42}{84}\ \Big|\ 7)\frac{21}{42}\ \Big|\ 3)\frac{3}{6}\ \Big|\ \frac{1}{2}\quad \textit{Facit.}$$

Here I firſt halve them, till I come to $\frac{21}{42}$ which I divide by 7, which brings $\frac{21}{42}$ to $\frac{3}{6}$, which reduc'd by 3, brings the Fraction to $\frac{1}{2}$, its loweſt Terms.

Ex. 3. Reduce $\frac{990}{1584}$

$$2\Big\{\frac{990}{1584}\ \Big|\frac{3}{3}\Big|\ \frac{495}{792}\ \Big|\frac{3}{3}\Big|\ \frac{165}{264}\ \Big|\frac{11}{11}\Big|\ \frac{55}{88}\ \Big|\ \frac{5}{8}\quad \textit{Facit.}$$

In this Example I abreviate by 2, then by 3, and again by 3, and laſtly by 11, as may be ſeen *per* Work; ſo the Fraction $\frac{990}{1584}$ in its loweſt Terms is $\frac{5}{8}$, and is equal in Value with $\frac{990}{1584}$, and anſwers the ſame End in Operation, but in much fewer Figures, as I ſhall ſhew when I come to apply Fractions to their proper Uſes.

When the Numerator and Denominator end each with a Cypher or a 5, or one with a 5 and the other with a Cypher; then 5 will ſerve for the common Diviſor to both.

Example, Let $\frac{30}{45}$ be reduc'd to its loweſt Terms.

$$5)\frac{30}{45}\Big|\frac{6}{9}\quad \textit{Facit.}$$

Again abreviate 5)$\frac{250}{485}$.

Facit $\frac{50}{97}$.

When there are Cyphers or a Cypher in the Numerator and Denominator, cut them off, and abreviate as before, and the Fraction ſhall have the ſame Value.

Example, Reduce $\frac{250}{450}$, thus,

5|$\frac{25}{45}$|$\frac{0}{0}$|$\frac{5}{9}$ *Fac.* and $\frac{300}{400}$ makes $\frac{3}{4}$.

III. *To Reduce a Compound Fraction to a Simple One of the ſame Value.*

Rule

Multiply all the Numerators together for a new Numerator, and all the Denominators together for a new Denominator.

Example, Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$ of a Pound.

Facit $\frac{30}{72}$.

Here I ſay, twice 3 is 6, and 5 times 6 is 30, for a Numerator; then 3 times 4 is 12, and 6 times 12 is 72, for the Denominator; ſo that $\frac{30}{72}$ is equal with $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$ of a Pound, which is 8*s*.4*d*.

Example 2. Reduce $\frac{6}{7}$ of $\frac{7}{8}$ of $\frac{9}{10}$ of a Hundred Weight.

Facit $\frac{378}{560}$.

Here I ſay 6 times 7 is 42, and 9 times 42 is 378, for the Numerator, then 7 times 8 is 56, and 10 times 56 is 560, for the Denominator, which Fraction $\frac{378}{560}$ of a Hundred Weight is 22 ℔, $\frac{4}{5}$.

IV. *To Reduce a Whole Number into an Improper Fraction.*

Rule

This is done, either by ſetting the propoſed whole Number for the Numerator, and a Unit for the Denominator, as thus 8 Integers may be reduced to $\frac{8}{1}$, or by aſſigning a Denominator to the Integers propoſed, and multiplying them by the ſaid Denominator, and the Product ſhall be the Numerator to the ſaid Denominator.

Example, Suppoſe 12 Integers were to be reduc'd to an Improper Fraction, whoſe Denominator ſhall be 4; multiply 12 by 4, and the Product is 48, for the Numerator to the Denominator 4; ſo the Improper Fraction $\frac{48}{4}$ equal 12 Integers.

V. *To Reduce a Mixt Number into an Improper Fraction.*

Rule

Multiply the whole Number by the Denominator of the Fractional Part, and add or take in the Numerator.

Example, Reduce *l.* 15 $\frac{7}{8}$ to an Improper Fraction.

$$\begin{array}{r} 15 \\ 8 \\ \hline \frac{127}{8} \end{array}$$ *Facit.*

Thus I multiply 15 the whole Number by 8, the Denominator of the Fractional Part, and take in 7 the Numerator, ſo $\frac{127}{8}$ is equal to the mixt Number 15 $\frac{7}{8}$.

Ex. 2. Reduce the mixt Number 124 $\frac{5}{8}$ to an Improper Fraction.

Facit $\frac{997}{8}$.

VI. *To find the Value of a Fraction in the known Parts of the Integer.*

Rule

Multiply the Number of the next inferior Denomination, contain'd in the Integer, by the Numerator, and divide the Product by the Denominator.

Ex. 1. What is $\frac{3}{4}$ of a Pound, or 20 *s* ?

3

4) 60

15 *s.* Anſwer.

Here I multiply the Integer 1 Pound in its next Inferior Denomination, *viz.* Shillings, being 20, by the Numerator 3, and it produces 60, which I divide by the Denominator 4, and it quotes 15 *s.* for the Anſwer; ſo that 15 Shillings is equal to $\frac{3}{4}$ of a Pound.

Ex. 2. What is $\frac{5}{6}$ of a Pound or 20 *s.* Anſ. 16*s.* 8*d.*

5

6) 100

16 *s.* $\frac{4}{6}$ or $\frac{2}{3}$ An

He

Here I multiply and divide as above directed, and there remains 4 which ſet over 6 the Diviſor, ſignifies $\frac{4}{6}$ of a Shilling, which is 8 *d.* and in its loweſt Terms it is $\frac{2}{3}$ of a Shilling, which is the ſame.

Ex. 3. What is $\frac{6}{16}$ of a Pound? Anſwer 7 *s.* 6 *d.* for 8 the Remainder is the half of 16 the Diviſor, and ſignifies half a Shilling, or Sixpence, as *per* Margin.

```
      20
       6
   ------ s.d.
6) 120 ( 7,6.
   112
   ----
    8/16
```

Ex. 4. What is $\frac{3}{7}$ of a Hundred Weight?

```
      l.
     112
       3
    ----
7)  336
    ----
Anſwer, 48 l.
```

More Examples with their *Facits* for Practice.

What is $\frac{5}{7}$ of an Ell Engliſh?

```
        Nls.
          20
           5
        ----
     7) 100
        ----
Facit Nails 14 2/7
```

VVhat is $\frac{6}{7}$ of a Pound Sterling?
Anſ. 17 *s.* 1 *d.* $\frac{1}{2}$ $\frac{6}{7}$.
What is $\frac{7}{8}$ of a Shilling?
Anſ. 10*d.* $\frac{1}{2}$.

What is $\frac{6}{8}$ of 100 *l.* Sterling ?

Anſ. 75 *l.*

What is $\frac{7}{10}$ of a Tun of Wine, (252 Gallons being the Integer ?)

Anſ 176 Gall. $\frac{4}{10}$.

What is $\frac{12}{16}$ of a Tun Wt. Averdupois ?

Anſ. 15 C.

What is $\frac{2}{3}$ of a Foot ?

Anſ. 8 Inches.

What is $\frac{3}{4}$ of a Pound Averdupois ?

Anſ. 12 Ounces.

Rule

VII. If you would know what Part of a Pound any Shillings and Pence are, or what Part of a Tun any Quantity of Hundreds, Quarters and Pounds are, *&c.* bring them into the loweſt Name mentioned for a Numerator, and likewiſe bring the Integer into the ſame Name for a Denominator, and then reduce the Fraction into its loweſt Terms by the 2d Rule of this Chapter.

Example, What Part of a Pound is 12 *s.* 6. *d* ?

```
                                12
   20 s.                       ----
   12              Numerator   15,0 }
  ----                         ---- }  5/8
   240       Denominator       24,0 }
```

Here 12 *s.* 6 *d.* make 150 Pence, for the Numerator, and 240 Pence (thoſe in a Pound) the Denominator, which abreviated by 3, brings the Fraction to $\frac{5}{8}$, as in the Work.

ADDITION

ADDITION

OF

VULGAR FRACTIONS.

1. IF the Fractions to be added have a common Denominator, then add all the Numerators together for a Numerator; and place it over the Common Denominator.

Example, What is $\frac{2}{8}$ $\frac{3}{8}$ $\frac{4}{8}$ and $\frac{5}{8}$ of a Pound?

Here 2 & 3 is 5, & 4 is 9, & 5 is 14, the Numerator, which ſet over the Denominator 8, makes the Improper Fraction $\frac{14}{8}$. To find the Value of which divide the Numerator 14 by the Denominator 8, ſaying, the 8's in 14 1, and there remains 6, which ſet over the 8, ſignifies $\frac{6}{8}$ of a Pound, or 6 Half Crowns; ſo the Value of the Improper Fraction $\frac{14}{8}$ is found to be 1 *l.* 15 *s.*

2. If the Fractions to be added have not a common Denominator, thon they muſt be reduc'd to one, according to the 1ſt Rule of this Chapter.

For *Example*. Let be added $\frac{2}{3}$ $\frac{3}{4}$ $\frac{5}{8}$ & $\frac{7}{8}$ of a Pound together, it being the firſt Example of the abovementioned Rule, and being there reduc d to a common Denominator, they ſtand thus $\frac{384}{576}$ $\frac{432}{576}$ $\frac{480}{576}$ and $\frac{504}{576}$, and the Numerators being added together they make 1800, which ſet over the common Denominator 576 conſtitute this Improper Fraction $\frac{1800}{576}$, which reduc'd as directed in the firſt Rule of this Chapter of *Addition*, it will be found to be 3 *l.* $\frac{72}{576}$, which reduc'd to its loweſt Terms *per* 12 and 6, gives $\frac{1}{8}$ of a Pound, or Half a Crown; ſo theſe Fractions added together make 3*l.* 2*s.* 6*d.*

SUBSTACTION

OF

VULGAR FRACTIONS.

AS in *Addition*, if the Fractions are of unequal Denominators, they muſt be reduc'd to a common Denominator, before *Subſtraction* can be made; then ſubſtract one Numerator from the other, and ſet the Difference over the common Denominator.

Example, Subſtract $\frac{16}{24}$ of a Pound from $\frac{21}{24}$.

Facit $\frac{5}{24}$, for 16, the firſt Numerator, from 21 the ſecond, reſt 5 which plac'd over the common Denominator 24, makes $\frac{5}{24}$ for the Difference, or 4*s.* 2*d.*

Ex. 2. From $\frac{7}{8}$ of any thing take $\frac{3}{8}$, and there reſts $\frac{4}{8}$, or $\frac{1}{2}$.

II. *To Subſtract a Fraction from a whole Number.*

Rule

Subſtract the Numerator from the Denominator, and the Remainder place over the given Denominator, and take a Unit from the whole Number for what you borrow'd, and the Remainder place before the Fraction found, which mixt Number ſhall be the Difference ſought.

Example, Take $\frac{6}{9}$ from 25 *l*, Say, 6 from 9 and there reſts 3, which place over 9 thus $\frac{3}{9}$, then 1 from 25 and there reſt 24; ſo the Remainder is 24 $\frac{3}{9}$.

III. *To Subſtract a mixt Number from a whole Number.*

Rule

From the Denominator of the Fraction take the Numerator, and ſet the Remainder over the Denominator, and take 1 from the whole Number.

Example, Take 5*s*. $\frac{3}{8}$ from 12*s*. Say, 3 from 8 and there reſt 5, and ſet it over 8 thus $\frac{5}{8}$, then 1 and 5 is 6 from 12, and there remains 6; ſo the Difference is 6*s*. $\frac{5}{8}$, or 6*s*. 7*d*. $\frac{1}{2}$.

Ex. 2.

	Ells	
From	24	
Take	19 $\frac{3}{5}$	
Ells	4 $\frac{2}{5}$	Anſwer

IV.

IV. *To Subſtract a mixt Number from a mixt Number*

Rule

Take the leſſer Numerator from the greater, *&c.*

Example, Take 23 *l.* $\frac{5}{8}$ from 37 *l.* $\frac{7}{8}$
23 $\frac{5}{8}$

Anſwer 14 $\frac{2}{8}$

V. *To take a Greater Fraction from a Leſſer.*

Rule

Take the Numerator of the Greater Fraction from its Denominator, and put the Remainder to the Numerator of the Leſſer Fraction, which is borrowing an Integer, *&c.*

Example, Take 24 C. $\frac{12}{16}$ from 35 $\frac{7}{16}$
24 $\frac{12}{16}$
C. qrs. lb.
Anſwer C. 10 $\frac{11}{16}$ or 10, 2, 21.

MULTIPLICATION

O F

VULGAR FRACTIONS.

Rule I. IF the Fractions to be multiplied be ſimple Fractions, then multiply all the Numerators continually for a Numerator, and all the Denomiminators together for a new Denominator, and that new Fraction gives the Product.

Example, multiply $\frac{2}{3}$ of a Pound by $\frac{3}{4}$ of a Pound. Here twice 3 is 6, and 3 times 4 is 12; ſo $\frac{6}{12}$ or $\frac{1}{2}$, is the Product of $\frac{2}{3}$, multiplied by $\frac{3}{4}$ of a Pound.

Here may be noted, That Multiplication in Fractions leſſens the Product, whereas it is increaſed in whole Numbers.

Ex. 2. Multiply $\frac{7}{8}$ of a Pound *per* $\frac{9}{10}$. *Fac.* $\frac{63}{80}$.

Rule II. When a compound Fraction is to be multiplied by a ſimple one, reduce the compound Fraction into a ſimple one, and then work as before.

Example, multiply $\frac{3}{8}$ of a Pound by $\frac{5}{8}$ of $\frac{3}{4}$. The compound Fraction reduc'd to a ſimple one makes $\frac{15}{32}$, which multiplied by $\frac{3}{8}$ makes $\frac{45}{256}$, for the Anſ. being 3*s*. 6 $\frac{48}{256}$.

Rule III. *To multiply mixt Numbers by mixt Numbers.*

Multiply 2*s*. $\frac{1}{3}$ by 1*s*. $\frac{2}{4}$: Theſe being reduc'd Simple to Simple Fractions according to the Rule, make $\frac{7}{3}$ and $\frac{6}{4}$, which multiplied according to the Firſt Rule of this Chapter, make $\frac{42}{12}$, which improper Fraction being reduc'd to a mixt Number, according to the Rule in *Reduction*, gives 3*s*. $\frac{6}{12}$. or 3*s*. 6*d*. for the Anſwer; ſo that 2*s*. 4*d*. multiplied by 1*s*. 6*d*. produces 3*s*. 6*d*. *Note*, That mixt Numbers muſt be brought into improper Fractions as above, *&c.*

Rule IV. When a mix'd Number is to be multiplied by a Fraction, reduce the mixt Number into an Improper Fraction. and work as before.

Example, Multiply 4 *l.* $\frac{3}{8}$ by $\frac{4}{12}$ of a Pound.
8

$$\frac{35}{8} \qquad \frac{140}{96}\ \textit{fac.}$$

Here I ſay 8 times 4 is 32, and 3 taken in makes $\frac{35}{8}$, then 4 times 35 is 140, and 12 times 8 is 96. This Example is 4*l.* 7*s.* 6*d.* multiplied by 6 *s.* 8*d.* which if reduced as above, gives 1*l.* 9*s.* 2*d.* for the Product.

Multiply 19 *l.* $\frac{4}{5}$ by 27 *l.* $\frac{7}{8}$.
Facit $\frac{2207}{40}$ or 551 *l.* 15*s.*
This Example is 27*l.* 17*s.* 6*d.* multiplied by 19*l.* 16*s.*

Rule V. *To take any Part or Parts of a Number.*

MUltiply the Number by the Fraction expreſſing the Part or Parts, and the Product gives the Part deſired.

Ex. 1. What is $\frac{1}{6}$ of 54 *l.*
Facit $\frac{54}{6}$, or 9*l.*

Ex. 2. Wat is $\frac{3}{8}$ of 144 Gallons?
Facit $\frac{432}{8}$ or 54 Gallons.

DIVISION

DIVISION

OF

VULGAR TRACTIONS.

1. IF the Fractions to be divided be ſingle Fractions, and have a common Denominator, then divide one Numeratot by the other, and place the Quotient over the common Denominator.

Ex. 1. *Divide* $\frac{4}{16}$ *per* $\frac{2}{16}$. *Facit* $\frac{2}{16}$.

Ex. 2. *Divide* $\frac{24}{68}$ *per* $\frac{6}{68}$. *Facit* $\frac{4}{68}$.

2. If the Numerators be not ſingle Fractions, then they muſt be reduc'd to ſingle Fractions with common *Denominators*, and then divided as above.

Example. Divide 2*l.* $\frac{2}{3}$ by 1*l.* $\frac{}{5}$. which being reduced make $\frac{8}{3}$ & $\frac{6}{5}$, which reduced to a common *Denominator*, and divided as above, quotes 2*l.* $\frac{4}{18}$

Note, That in *Diviſion* of proper Fractions, when the *Deviſor* is leſs than an Unit, the Quotient is always greater than the *Dividend.*

Or the Example above, *viz.* $\frac{8}{3}$ and $\frac{6}{5}$ (being ſingle Fractions) may be divided, reducing them to a common *Denominator*, thus, multiply the Numerator of the *Dividend* into the *Denominator* of the *Diviſor*. and the Product is a new Numerator; alſo multiply the Denominator of the Dividend by the Numerator of the Diviſor, and the Product is a new Denominator, which Fraction is the Quotient ($\frac{8}{3}$ & $\frac{6}{5}$) thus 5 times 8 is 40, the Numerator, and 6 times 3 is 18, the Denominator, and make the Fraction $\frac{40}{18}$.

Of Decimal Fractions.

1. A Decimal Fraction is an artificial Way of expreſſing a Vulgar Fraction, by ſetting down the Numerator only, the Denominator being underſtood, which is always a Unit with as many Cyphers annexed, as there are Places in the Numerator, and therefore muſt be either 10, 100, 1000, 10000, 100000, *&c.*

2. A Decimal Fraction is diſtinguiſhed from a whole Number by having a Comma or Point prefix'd before it thus ,5 and ſignifies 5 Tenths of a Unit, whereas without the Point beſore it, it would be 5 Units. For the better Uuderſtanding this 2d Definition, and to know how Vulgar Fractions are expreſs'd by Decimals, obſerve the following Notes of Diſtinction, *viz.*

Vulg.		Decimally
$\frac{5}{10}$	Thus expreſs'd	,5 Five Tenths or a Half.
$\frac{25}{100}$		,25 Hundredths or a Quarter,
$\frac{75}{100}$		,75 Hundredths or Three Quarters.
$\frac{246}{1000}$		,246 Thouſandths.
$\frac{6}{100}$		,06 Six Hundredths.
$\frac{54}{10000}$		,0064 Ten Thouſandths.

3. As a whole Number increaſes by a Ten-fold Proportion from the Units Place to the Left-hand, ſo Decimals decreaſe in the ſame Proportion, from Unity to the Right-hand, as may be obſerv'd by the following Table.

C's of Millions	X's of Millions	Millions	C's of Thouſands	X's of Thouſands	Thouſands	Hundreds	Tens		Primes	Seconds	Thirds	Fourths	Fifths	Sixths	Sevenths	Eighths
9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9

A B

The Table A ſignifies Integers, and the Table B Parts of Integers, thus the Figure 2 in the Table A ſignifies 2 Tens, or twice 10 Units, but the Figure 2 in the Table B ſignifies but 2 Primes, or ,2 Tenths of Unity; ſo 3 in the Table A is Three Hundreds, but in the Table B, 3 ſtands for 3 Seconds, or Three Hundred Parts of Unity, *&c.*

Cyphers before Integers and after Decimals, have no Value; but after Integers and before Decimals they have, for though they ſignify nothing of themſelves (as was ſaid in the Chapter of *Numeration*) yet in Integers they augment, and in Decimals they diminiſh the Value of the other Figures; for 06 in whole Numbers is but 6, and 006 is no more, but in Decimals, by prefixing a Comma before it thus ,6 is decreaſed from 6 to Six Tenths of a Unit, and with a Cypher and Comma before it thus ,06 to Six Hundred Parts of a Unit, *&c.* but a Cypher or Cyphers on the Right-hand of 6 ſignifies 60, in Decimals, but Six Tenths, and if 2 or more thus 600, be annext, yet ſtill it is no more, *&c.*

This Sort of *Arithmetick* addeth, ſubſtracteth, multiplyeth, and divideth whole Numbers and Fractions together, and gives their Totals, Remainders, Products, and Quotients in whole Numbers and Fractions, without the Help of *Reduction.*

Before I ſpeak of *Addition* of Decimals, tis neceſſary to ſhew how to reduce a Vulgar Fraction into a Decimal.

Rule—Annex 1, 2, 3 or more Cyphers at Diſcretion to the Numerator, and divide by the Denominator, and the Quotient is the Decimal required, and of the ſame Value with the Vulgar Fraction, or infinitely near, as the 1000000 Part of a Farthing, a Dram, or a Grain, *&c.*

Example, What is $\frac{1}{4}$ of any Thing reduc'd to a Decimal?

4) 100

,25 Anſwer.

Ex. 2. Reduce $\frac{3}{4}$ of any thing to a Decimal.

4) 3000

,75 *Facit.*

What is the Decimal of 12 *s.* $\frac{12}{20}$? $\frac{1200}{20}$) ,6 Anſwer.
What is the Decimal of 17 *s.* $\frac{170}{20}$),85 Anſ.
What Decimal of 1 C Wt. is 84*l.* $\frac{840}{112}$ (,75 *l.* Anſ.

Thus any Number of Shillings, Pence, Ounces, *&c.* are reduced into Decimal Fractions, by dividing *per* their Integers (after a competent Number of Cyphers are annex'd, 5 or 6 at the moſt generally being enough) *viz.* Shillings *per* 20, Pence *per* 240, Farthings *per* 960, Ounces, *Avoirdupois* and *Troy*, *per* 16 and 12, Hours *per* 24, Days *per* 365, *&c.*

So	15 *s.*	is	,75.
	16, 8 *d.*		,833.
	3 Oz. *Troy.*		,25.
	9 Oz. *Avoirdupois.*		,5625.

Addition

Addition and Subſtraction

O F

DECIMALS.

ADdition and *Subſtraction* of Decimals differs no from that of whole Numbers, in the Work but Regard muſt be had in placing the Numbers properly under one another, *viz.* the whole Numbe muſt ſtand one under another, as in whole Numbers Units under Units, &c. and the Decimal or Fractional Part [if it be a mixt Number] muſt ſtand thus Primes under Primes, Seconds under Seconds, &c and then begin at the Right-hand as in whole Numbers, and for every 10 carry or borrow 1, as there alſo; &c. *Note*, you muſt make the Comma's or Point of Separation, to diſtinguiſh the whole Numbers fro the Fractions.

EXAMPLES.

Decimals	Int.	Parts			s. d.
,473	25	,5	,333		6, 8
,024	7	,75	,25		5, 0
,75	27	,046	,75	equal	5, 0
,076	9	,7246	,003	to	0, 0 $\frac{3}{4}$
,245	4	,5	,3		6, 0
,7	36	,0024	,666		13. 4
2, 268.	110	,5230.	*l.* 2, 302.		*l.* 2, 6, 0, $\frac{3}{4}$

Note, you point off as many Figures for Decimal Parts as there are in the greater Number.

The Firſt of theſe Examples is 2 Integers and ,268 Decimal Parts; the Second 110 Integers and ,5230; nd the laſt 2 and ,302 Parts, or *l.* 2, 6, 0, $\frac{3}{4}$.

SUBSTRACTION.

,44706	,86503	4	,729	36	,272
,17294	,05983	1	,987	19	,5
,27412.	,80520.	2	,742.	16	,772.

MULTIPLICATION

O F

DECIMALS.

MULTIPLICATION of Decimals is the ſame in Operation as in Integers: only when the Work is done you muſt point off towards the Right hand as many Figures or Cyphers as there are Decimal Places in both the Multiplier and Multiplicand, and thoſe Figures towards the Left-hand are Integers, and thoſe pointed off to the Right are Decimal Parts.

Example,

Multiply ,666 by ,666 or 13*s*. 4*d*. by 13*s*. 4*d*.

```
       ,666
    --------
       3996
      3996
     3996
    --------
     ,443556
    --------
```

Multiply *l.* 45,75
By ,25

22875
9150

11,4375

Anſ. 11 Int. & ,4375 Parts.

,0053	,64	4,64	5,32
,12	8	,93	,48
,000636	,512	1392	4256
		4176	2128
		4,3152	2,5536

If when after Multiplication there are not ſo many Places to point off, as there are Fractional Places in both the Factors, then ſuch Defect muſt be ſupplied by Cyphers, as above.

DIVISION
OF
DECIMALS.

DIVISION, whether in entire Decimals, or in Integers and Decimals, the Operation is the ſame in whole Numbers; but Regard muſt be had how to denominate the Quotient, which may be done by this Rule. *viz.* The firſt Figure of the Quotient will be of the ſame Degree, Place or Denomination with that Figure or Cypher in the Dividend, which ſtandeth over the Place of Units in the Diviſor.

Example, Divide ,3658 by ,25, and explain the Value of the Quotient, the Work performed as in Integers. The Quotient is (after two Cyphers annext) 14632, to find the Value ſubſcribe the *Diviſor* under the *Dividend*, and ſee if the Units Place in the *Diviſor* ſtands under the Units Place in the *Dividual*, as *per* Margin.

0, 25) 0,3658 (1,4632
02500

Note, There muſt be as many *Decimal* Places in the *Diviſor* and Quotient, as there are in the *Dividend*; if not the Defect muſt be ſupplied by Cyphers annext to the Left-hand of the Quotient, and is the reverſe of *Multiplication*.

When the *Diviſor* conſiſts of more Places than the Dividend, then a competent Number of Cyphers muſt be annexed to the Dividend, before *Diviſion* can be made.

Example, *Divide* 75 by 375, here I muſt annex two or more Cyphers to the Dividend 75, thus 7500 before I can work as uſual. 375) 7500 (,20 or 2 Tenths
750

Divide 12,666003 by ,625) 12,666003 (20 ,265 Anſ.

Divide 48,000 by 12,5) 48,000 (3,84 Anſwer.

Divide 8,750 by 5,5) 8750) 1,59 Anſwer.

The Rule of Three in Vulgar and Decimal FRACTIONS.

THE *Rule of Three* in Fractions differeth very little from that in whole Numbers, for Firſt and Third Numbers muſt be of one Kind, and the Second and Third Numbers are multiplied together, and *Diviſion* made by the Firſt.

Example, If $\frac{3}{4}$ of a Yard of Cloth coſt $\frac{4}{5}$ of a Pound, what $\frac{2}{4}$ of a Yard?

The Queſtion ſtanding thus rightly ſtated, the Anſwer may be thus briefly found, *viz.* multiply the Denominator of the Diviſor into the Numerators of the other two Fractions, or Second and Third Numbers, and they make 30 for a new Numerator, then multiply the Numerator of the Diviſor into the Denominators of the other two Fractions, and they make 60 for a Denominator; ſo this new *Fraction* $\frac{30}{60}$ is the Anſwer, to wit, in its loweſt Terms, $\frac{1}{2}$ a Pound, or 10 *s.*

Decimally.

If ,75——,0800——,5
5

,75) ,04000 (,5 or 10*s.*
375

25

This and the following Decimal Statings, are worked juſt as whole Numbers.

Ex. 2. If $\frac{3}{4}$ of C. $\frac{4}{5}$ of a Pound, what $\frac{5}{6}$ of C. by the Rule above makes?
Anſ. $\frac{80}{90}$ of a Pound, or 17*s.* 9*d.* $\frac{1}{3}$.

Decimally.

If ,75 Yards ,8 lb, what,833 Yards?
Anſ. ,888 or 17*s.* 9*d.* $\frac{1}{3}$.

*Ex.*3. If 2lb $\frac{3}{4}$ of Tobacco coſt 3*s.* $\frac{1}{2}$, what 242lb $\frac{1}{4}$?
Anſ. *l.* $\frac{3391}{220}$, or *l.* 15, 8, 3.

Decimally.

If 2,75 lb——3*s.* ,5——242 lb ,25.
Anſ. 308,3 or *l.* 15, 8, 3.

MEN-

MENSURATION

OF

PLAINS and SOLIDS.

MENSURATION conſiſteth of two Parts, *viz.* Superficial and Solid Meaſure.

Superficial Meaſure	hath	Length and Breadth.
Solid Meaſure		Length, Breadth, and Depth, or Thickneſs.

	Inches.		
Diviſors	144	in a	Superficial Foot ſquare.
	1728		Solid Foot.

To the firſt of theſe Meaſures, *viz.* Superficial, belong the Meaſuring of all Surfaces, or flat Meaſure, ſuch as Board, Glaſs, Pavement, Wainſcot, Tyling, *&c.*

To the latter belong the Meaſuring of Timber round and ſquare, Stone, Brickwork, and Digging, *&c.*

A General Rule for Superficial Meaſure.

Multiply the Length in Inches by the Breadth in Inches, and divide by 144, the Superficial Inches in a Foot ſquare, as above.

Ex. 1. Suppoſe a Shuffle-Board Table to be 24 Foot 9 Inches long, and 5 Foot 3 Inches broad, how many Superficial Square Feet doth it contain?

F. I.	F. I.	Inch.
24, 9 Length	5, 3 Breadth	297 Length
12	12	63 Breadth
297	63	891
		1782
		Ft. Inch.
		144) 18711 (129, 11,¼ Anſ.

Firſt reduce the Length into Inches, and they make 297, then the Breadth into the ſame, and they make 63 Inches, which multiplied into each other make 18711 Square Inches, which divided by 144 the ſquare Inches in a Superficial Foot, quote 129 Foot, 11 ¼ ſquare, as may be ſeen in the Work.

Note, That the ſquaring any Number is multiplying them into one another, as above; multiplying 297 Inches by 63 Inches produces 18711 Inches ſquare.

This Method of multiplying the Inches in Length by the Inches in Breadth, and then dividing by 144, is a good, old, and ſure Way of Calculation, and from the Commoneſs of its Uſe, is call'd the Vulgar Way; but to thoſe that are more curious, I ſhall ſhew 3 other Ways of caſting u

Dimentions of this Sort, *viz.* 1ſt *Decimally*, 2dly, by *Croſs Multiplication*, and 3dly, *Practically*.

Decimally.		*By Croſs Multip.*	*Practically*
Length 24.75		F. In.	F. In.
Breadth 5.25		24, 9 Length	24, 9
		5, 3 Breadth	5, 3
12375			
4950		120, 0	123, 9
12375		6, 0	6, 2 $\frac{1}{4}$
	Foot Inc.	3, 9	
129.9375	129, 11 $\frac{1}{4}$	2 $\frac{3}{12}$ or $\frac{1}{4}$	Anſ. 129 11 $\frac{1}{4}$
12			
		Anſ. 129, 11 $\frac{1}{4}$	
11.2500			
4			
1.0000			

Theſe are the ſeveral Ways of caſting up Dimentions, the middle of the Three above is very much practis'd among Artificers, and the laſt (which I think is the beſt) I had from Mr. *G. F.* a good Accomptant, and Arithmetician, who hath a Work of this Kind now extant. The Operation of each is very plain, but I ſhall give a verbal Explanation for the Uſe of the intelligent Reader.

The Decimal Operation.

In the Firſt I multiply the Length by the Breadth, according to the Doctrine of Decimals before taught, and after 4 Places are ſeparated for the 4 Places in the Fractional Parts of the Multiplier and Multiplicand, there comes out 129 Foot, then I multiply the Remainder *per* 12 (the Inches in a Foot) and cut off 4 Places as before, and there comes out 11 Inches, and then I multiply the Remainder *per* 4, (the Quarters in an Inch) and then after 4 Places cut off) there comes out the Quarter of an Inch.

The Croſs Multiplication Work.

Firſt I multiply the whole Numbers 24 F. and 5 F. together, and they make 120 F. then I multiply 24 by Croſs-ways, (from whence the Work hath its Name) and it produces 72, which divided by 12, gives 6 Foot, then I multiply 5 F. croſs-ways by 9, which makes 45, which alſo divided *per* 12, gives 3 Foot 9 Inches; laſtly, I multiply the Inches together, *viz.* 9 *per* 3, which produces 27, which likewiſe divided by 12, quotes 2 Inches $\frac{3}{12}$ or $\frac{1}{4}$, as in the Work.

The Practical Way.

Firſt ſet down the Length 24 Foot 9 Inches, and multiply it by the Breadth 5 Foot 3 Inches, ſetting the 3 Inches behind as in the Work, and ſay, 5 times 9 is 45, I ſet down 9, and carry 3 for the 3 Foot, then 5 times 4 is 20, and 3 is 23, 3 and carry 2, then 5 times 2 is 10, and 2 is 12, ſo the Product by 5 is 123 Foot 9 Inches; then I conſider that 3 Inches is the $\frac{1}{4}$ of a Foot, wherefore I take $\frac{1}{4}$ of 24 Foot 9 Inches, and it quotes 6 Foot 2 Inches and $\frac{1}{4}$, which added to 123 *Foot* 9 Inches, makes 129 *Foot*, 11 Inches and $\frac{1}{4}$, as in the Example of Operation.

Artificers have different Ways of giving in the Contents of their Work, according to the Cuſtom of each Trade; ſome give the Contents in Rods, as *Bricklayers*, *&c.* others in Yards, as Joyners, *&c.* ſome in Squares, as Carpenters in flooring, roofing, and Bricklayers in Tyling, *&c.* and others in running Meaſure, which is only Length without Breadth (conſider'd) by a Line, by which moſt Kinds of Ornamental Work are meaſured, as Cornice, Frize, *&c.*

Inſtructions for Joyners, Painters, Plaiſterers, &c. whoſe Work is meaſured by the Yard.

As Rooms are various in their Forms, take this general Rule in all Caſes.

Take a Line, and apply one End of it to any one Corner of the Room, then meaſure the Room, going into every Corner with the Line, until you come at the Place you began at, then meaſure how many feet and Inches the Line contains, and ſet it down; then meaſure the Height by the ſame Method, going into every Angle of the Moulding, and ſet that down under the other, then multiply the one by the other according to any of the Three laſt Methods, and divide the Product by 9, the feet in a Yard ſquare, and the Quotient will be Yards ſquare of Joynery, Painting, or Plaiſtering.

Now I ſhall ſhew ſundry Examples of caſting up Dimentions of various Kinds in Superficial Meaſure, but ſhall make uſe only of the laſt Method of the 3 for caſting up feet and Inches.

Joyners Work meaſured by the Yard ſquare.

Ex. 1. What is the Content of a Piece of Wainſcoting in Yards ſquare, that is 8 foot 3 Inches long, and 6 foot 6 Inches broad ?

I divide the feet and Inches by 9 to bring them into Yards ſquare.

6, 6
In. 49 —— ,6
6 $\frac{1}{2}$ 4 —— 1 $\frac{1}{2}$
9) 53 —— ,7 $\frac{1}{2}$
5 ,8 ,7 $\frac{1}{2}$ Anſ. 5 Y. 8 f. 7 In. $\frac{1}{2}$.

Ex. 2. A Room wainſcoted, whoſe Dimentions are,
viz. *F.* I.
47 3 Compaſs
7 foot, 6 inches high
What's the Contents in ſquare Yards ?

I. 330 9
6 $\frac{1}{2}$ 23 7 $\frac{1}{2}$
9) 35 44 ^{1}
39, 3, 4 $\frac{1}{2}$

Anſw, yds. f. in. 39, 3, 4 $\frac{1}{2}$.

The Dimentions of Painting, Plaiſtering & Paving are caſt up after the ſame Method.

Ex. 3. A Room painted being

f. i.
45 8 about
10 foot, 6 inc. high
} What's the Content in Yards ſquare?

inch. 456 , 8
6$\frac{1}{2}$ 22 , 10
9) 479 6
yds. 53, 2, 6
} Anſwer yds. f. in. 53. 2, 6.

Ex. 4. The Ceiling of a Room plaiſter'd, *viz.* 19 f. 10 i. long, and 17 f. 6 i. broad, how many Yards?

ft. inc.
19,10
4,4
79 ,4 foot
4 16
317 ,4
in. 19,10 $\frac{1}{17}$
6$\frac{1}{2}$ 9,11
9) 347 ,1
yds. 38,5,1
} Anſwer yds. f. in. 38, 5, 1.

In this Work I multiply by 4, and then that Product again by 4; 4 times 4 being 16. and once 19 foot 10 makes 17 inches, *&c.*

Ex. 5 A Court Yard pav'd or pitch'd with Pebble being 13 yards and ½ long, and 5 yards and ¾ broad, how many ſquare Yards?

Yards
13 ½ Long
5 ¾ *Broad*

67 ½
6 ¾
3 ¼ ⅛
77 ½ ⅛

Anſ. 77 Yards ½ and half Quarter.

Here I ſay 5 Halves is 2 ½, I ſet down ½ and carry 2, then 5 times 3 is 15 and 2 is 17, 7 and carry 1; then 5 times 1 is 5 and 1 is 6, and is 67 Yards and ½, then I take ¾ of 13 Yards and ½, ſaying the half of 13 is 6, and there remains 1 Yard, which is 4 Quarters, and 2 is 6 Quarters, then the half of 6 is ¾, then the half of that Line is 3 Yards ¼ and ⅛, which put together makes 77 Yards ½ and half Quarter, as in the Work.

Ex. 6. A Window glazed being

f.	inc.
8	9 high
7	3 inc. wide

how many foot ſquare?

	61	3
3 inc. is $\frac{1}{4}$	2	2$\frac{1}{4}$
	67	5$\frac{1}{4}$

Anſ. 67 ft. 5 in. and $\frac{1}{4}$.

A common Quarry of Glaſs of this form ◇ is 6 inches from Corner to Corner one way, and 4 inches the other, and contains 12 inches in all, and therefore 12 Quarries make a Foot of Glaſs.

When there are ſeveral Panes of Glaſs in one Room all of one Height, lay a String along the Glaſs of the Window, and take the Breadth of them all together into one Sum, and call it the Length, and the Height of one Pane the Breadth, and then caſt them up as before, not deducting for Oval, half round, or crocket Windows in Stone Work, becauſe of the Loſs of Glaſs, and Trouble of fitting them.

Or the Depth and Breadth of all Windows that are alike may be taken in inches; make a Sum of all the Depths, and alſo of the Breadths, and multiply one *per* the other, and divide *per* 144, and the Quotient will be the feet.

Example, Suppoſe there are 8 Windows of one Size, *viz.* 18 inches wide and 36 inches high; 36 multiplied by 18 produces 648 inches for one Window, which multiplied by 8 gives the ſquare inches in them all, which divided by 144, quotes 36 foot, as *per* Margin.

```
    inches
      36
      18
   --------
     648
       8
   --------ft:
144) 5184 (36
     432
   --------
     864
     864
   --------
     (0)
```

```
Or thus        ft. in.
                3 , 0
                  1 6
               -------
       inc.     3 , 0
       6 ½      1 , 6
               -------
                4 , 6
                    8
               -------
         ft.   36,0 Anſwer.
```

Board Meaſure.

Multiply the Length *per* the Breadth, and divide by 144, or according to the Practical Way, as above.

Example, If a Walnut Tree Plank be 32 f. 4 i. long, and 3 f. 9 i. broad, how many ſquare feet doth it contain?

```
32 f. 4 i. long,
      3,9
---------
 97 , 0 )
 16 , 2 (  Anſ.
  8 , 1 >  121 f
------- (   in.
121 , 3 )
```

Or if the Inches of the Length are multiplied by thoſe of the Breadth, and divided by 144, it quotes the ſame, and remains 36 equal to $\frac{1}{4}$ of a foot.

If a Board be broader at one End than another, then add the Dimentions of both Ends together, and take the $\frac{1}{2}$ of it for the mean Breadth, which multiply by the Length, and divide by 144, or by the Practical Method.

f. i.
3 3
2 6
———
5 9
$\frac{1}{2}$ ———
2 10$\frac{1}{2}$
10
———
28 9 *fac.*
———

Example, Suppoſe a Beechen Board be 39 inches broad at one End, and 30 inches broad at the other, and 120 inches long, what is the Content in ſquare feet? Anſw. 28 foot 9 inches, as by the Work in the Margin.

Firſt I add 39 inches, or 3 f. 3 to 30 inc. or 2 f. 6, which make 5 f. 9, the half of which is 2 f. 10 $\frac{1}{2}$, which multiplied by 120 inches, or 10 foot, the Length, gives 28 f. 9 for the Anſwer.

Let a Plank be ever ſo irregular, it may be meaſured pretty exactly by taking the Breadth of it in 5 or 6 Places, and add the ſeveral Breadths together, and that Sum divide by the Number of Places you have taken the Breadths at, and the Quotient will be the mean Breadth.

inc.
15
12
13
9
6

5) 55

mean 11 b
f. i.
14 ,4 l.
i.
6 $\frac{1}{2}$ 7,2
3 $\frac{1}{2}$ 3,7
2 $\frac{1}{3}$ 2,4 $\frac{2}{3}$

fa. 13,1 $\frac{2}{3}$

Ex. Suppoſe a Plank Meaſure at the wideſt End 15 inches, and ſome Diſtance farther towards the narroweſt End 12 inches, and at another Place 13 inches, and a little farther 9 inches; and at the leſſer End 6 inches, what is the Content in feet, the Length being 14 foot 4 inches? Anſ. 13 ft. 1 in. $\frac{2}{3}$. firſt add the ſeveral Dimentions taken at 5 different Places together, and they make 55 inches, which divided by 5, the Number of Places the Breadth of the Board was taken at, it quotes 11 in. for the mean Breadth, and it being under a foot, I take Parts Practically, as in the Margin, and it gives 13 f. 1 i. & $\frac{2}{3}$ for the Content.

Having the Breadth of a Board in Inches, to know how much in Length of that Board will make a Superficial Foot.

Rule.

Let 144 be your Dividend, and the Breadth in inches be your Diviſor, and the Quotient ſhews what Quantity in Length of that Board will make a foot.

9) 144

16

Ex. If a Board be 9 inches broad, how much in Length of it will make a foot? Anſ. 16 inch. as in the Margin.

To meaſure round Pillars.

Multiply the Height by the Circumference.

To meaſure ſquare Pillars.

Add the Sides or Breadths together, and multiply the Total by the Height.

For Poligons (which are Figures of many Angles or Corners.

Add all the Sides together, and multiply the Total by the Length.

For Cones, or Circular Figures in Form of a Sugar-Loaf.

Multiply half the Length by the Circumference.

Menſuration of Solids.

SUch as Timber, Stone, Liquids, *&c.* theſe are meaſur'd by the Cubical foot of 1728 ſolid ſquare inches a Cube is a Solid, whoſe Length, Breadth and Depth are equal, and is in form of a Dye. of 6 equal Sides, and contains 12 inches ſquare on each Side, making 1728 inches.

To find the Solid Content of any Thing.

RULE.

Multiply the Length and Breadth together, and then that Product mutiply by the Depth, which laſt Product divide by 1728, and the Quotient gives the Content in Solid Feet for Timber or Stone. But in Liquids, if for Beer, you muſt divide by 282, and for Wine, 231, which are the Cubical Inches contain'd in a Beer and Wine Gallon, which 2 Numbers are us'd by all Gaugers for Diviſors, for they multiply the one Side of a ſquare Cooler into the other, and divide by 282 for Beer or Ale, *&c.* and the Quotient gives the Area, or Content, in Gallons, upon an Inch deep.

Note, That 50 Foot of Timber is a Load, and 40 Foot is a Tun.

Ex. 1. If a Piece of Timber be 16 Foot long, & 18 Inches ſquare, how many ſquare Feet doth it contain?

Inches	Foot	Decim.	Pract.
18 } ſquare	16 long	1,5	F. I.
18 }	12	1,5	1,6 I.
			9 6½
324 Inches	192 Inches	225 ſquare	
192 multi.		16 long	2,3
	ft.		4 & 4
1728)62203 Pro.(	36 Quot. Anſ.	36,00	
			9,0
			4
			foot 30,0 Anſ.

Ex. 2. Suppoſe a Stick of Timber to be 20 f. long 22 inch. broad, and 11 inch. thick, what's the Content in Solid feet?

f. in.
1 10 broad

Note, inches thick 11 — in. 6 $\frac{1}{2}$, 11
3 $\frac{1}{2}$, 5 $\frac{1}{2}$
2 $\frac{1}{3}$ of 6., 3 $\frac{2}{3}$

Anſ. 33 f. $\frac{7}{12}$.

1 ,8 $\frac{7}{12}$
10 mult. by 2 makes 20 f. lo.

16 ,8
2

Anſw. foot 33 ,4

Ex. 3. Admit a Piece of Timber to be 20 f.8 long, 2 f. 5 broad, & 2 f. thick, I demand the feet contain'd therein?

f. i.
20,8 long
2 f. 5 broad

in. 41,4
3 $\frac{1}{4}$ 5,2
$\frac{2}{3}$ $\frac{1}{6}$ - 3·5 $\frac{2}{6}$

49,11 $\frac{2}{6}$
2 f. thick

foot 99,10 $\frac{4}{6}$ Anſwer.

Having

Having the Breadth and Depth of a Piece of Timber, to know how much in Length will make a Foot Solid.

Rule

Multiplpy the Breadth and Depth together, and let the Product be Diviſor to 1728, and the Quotient gives the Anſ.

Example, 9 inches broad
8 inches deep

72)1728)24 inc. in Leng.

Ex. 4. If a Stone Meaſure 15 foot 6 inc. long, 4′ 3 broad, and 3 f. 3 thick, how many ſolid Feet doth it contain?

f. in.
15,6 long
4 f. 3 broad

inc. 3 ¼ — 62,0
3 10 ½

65,10 ½
3 f. 3 thick

197,7 ½
in. 3 ¼ of 65 f. 10 ½ } 16,5 ½ ¼

214,1 ½

foot i.
Anſ. 214 1

If a Piece of Timber be irregular, then girt it, or take its Dimentions at ſeveral Places, and add them together, and proceed as directed in Board Meaſure, only you divide by 1728 inſtead of 144.

f.
5 long
3 broad
15
2 ft. dp.
30 Anſ.

Ex. 5. Suppoſe a Stone be 5 foot long, 3 foot broad, and 2 foot deep, what is the Content?
Anſ. 30 ft. as *per* Margin.

To know how many ſquare inches are in a Tun, multiply 1728 by 40, and in a Load multiply the ſame by 50.

How many inches in a Yard ſquare, ſolid Meaſure, uſed in Digging?

36
36
216
108
1296
36
7776
3888
Anſ. 46656

If a Corde of Wood be 8 f. long; 4 foot high, & 4 foot br. how many foot doth it contain?
Anſ. 128 foot.

8
4
32
4
128

If a Cord of Wood be 14 f. long, 3 ft. high, & 3 ft. broad how many foot?
Anſ. 126 foot.

14
3
42
3
126

If I borrow a Piece of Timber that's 4 foot ſquare, and pay it again by 2 Pieces of 2 foot ſquare each, I deſire to know whether I pay as much Timber as I borrow?

4	2
4	2
16	4
4	2
64 ft. borrowed	8
	2
	16 paid

By the Work it is plain, that there is bu [illegible] paid, for the borrowed Piece contains 64 foot, and the 2 Pieces paid make but 16 foot.

Bricklayers-Work.

Tyling is meaſur'd by ſquare of 10 ft. as the Carpenters Work of roofing and flooring.

If a Piece of Tyling be 25 foot broad, and 48 long, how many ſquares?

I here divide by 100 (for 10 times 10 is 100) which is done only by cutting off 2 Figures towards the Right-hand, and thoſe toward the Left are Squares.

48 foot long
25 foot broad
240
96
12,00 Anſ. 1
Squares.

If Tyles lie 3 inches out, then 800 covers one Square, but if 3 inches and a half out, then 750 will do it.

800	750
12 Squares	12 Squares
9600	9000 covers the Roof of 12 Squares

Tiles ought to be 10 inches ½ in Length, and 6 in Breadth, and weigh about 2 lb ½. Ridge Tiles are about 14 inches long.

Brickwork is meaſur'd by the Rod ſquare of 16 foot ½, which makes (multiplied into its ſelf) 272 foot ¼, but the ¼ is neglected, and only 272 is the *Diviſor*.

foot
16 ½
16 ½

256
8
8

272 ¼

A Brick ought to be 9 inch. long, 4 inc. ½ broad, and 2 ¼ thick.

500 of Bricks }
1000 of Plaintiles } is a Load.

Paving Tiles are 6, 8, 9, 10 and 12 inches ſquare.

Suppoſe 4500 of Bricks make a Rod ſquare of Wall 13 inches or a Brick and a half thick, how many will build a Houſe 3 Rods high, and 12 Rods in Compaſs?

Anſw. 162000 Bricks in all.

3 high   4500
12   36
36   27000
13500
Anſw. 162000

If a Wall be in Length 120 foot, and 13 foot 3 inches high, what's the Content in Rods ſquare?

120,0
3,4
360,0
4
1440,0
120,0
30,0

272) 1590,0 (5 Rods $\frac{230}{272}$, or $\frac{3}{4}$ & half Quarter of a Rod.
1360
230

Having meaſur'd the Face of the Wall, or Houſe, on the outſide thereof, then meaſure the End thereof on the Inſide, and make Deduction for the Doors and Windows.

But if the Wall be either thicker or thinner than a Brick and ½, it muſt be reduc'd to Standard Meaſure, that is, to one Brick and a half, by this Rule, *viz.*

Multiply the Number of Feet meaſur'd on the Face of the Work, by the Number of Half-bricks the Wall hath in Thickneſs, and ⅓ Part of the Product gives the Number of feet that is in the Wall, which reduce into Rods by dividing by 272, the feet in a Rod ſquare.

Example, Suppoſe the Face of a Wall to meaſure 4085 foot, and the Thickneſs of the Wall to be 2 bricks & ½, or 5 half bricks, how many Rods doth it contain? Anſ. 25 Rods, as *per* Margin.

```
      4085
         5
    ------
⅓)  20425
    ------
272) 6808 )25 Rods
      544
    ------
     1368
     1360
    ------
      (8)
```

Digging.

Digging is meaſur'd by the ſolid Yard of 27 Foot.

Example, If a Pit be 18 foot broad, and 8 foot deep, and 20 foot long, how many ſolid Yards? Anſ. 106 Yards $\frac{2}{3}$, as in the Work.

F.
18 broad
8 deep
―――――
144
20 long
―――――
27) 2880 (106 $\frac{18}{27}$ or $\frac{2}{3}$
27
―――――
180
162
―――――
(18)

Note, A Yard ſquare of Clay makes about 7 or 800 of Bricks. The Price of making is about 6 or 7 *s. p.* m.

By this Method the Digging of Cellars, Vaults, *&c.* are calculated.

Thus I have given Hints concerning Meaſuring, which I hope may be of good Uſe to the Ingenious tho' much more might be ſaid, and more Examples given, with ſeveral Geometrical Figures drawn, which would ſwell this Book beyond its intended Limits.

F I N I S.